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A REVISION OF THE NORTH AMERICAN GENUS SABATIA (GENTIANACEAE)

by
Robert Lynch Wilbur

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A REVISION OF THE NORTH AMERICAN GENUS SABATIA (GENTIANACEAE)

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This study consists of a revision of the gentianaceous genus Sabatia. Nineteen taxa are recognized and plants of the genus are found from the valleys of southern Nova Scotia southward to the islands of the Caribbean and to the Mesa Central of Mexico and from the beaches and salt marshes of the Atlantic seaboard to the prairies of Oklahoma and Texas. The conclusions reached are based upon field experience with all but one of the species recognized, examination of more than sixty-five hundred specimens deposited in over thirty herbaria, and perusal of the literature. The genus has not been monographically treated within the past one hundred years. The most recent treatment of Sabatia, on other than a regional basis, was published more than a quarter of a century ago and consisted of little more than a skeletal outline. Twenty-two species were recognized at that time which is five more than are accepted in the present treatment.

The nineteen entities treated are naturally arranged in six groups of unequal size and morphological diversity. One of these is morphologically more strongly differentiated

from the other five than the latter are from each other. This division forms two units which are here considered to be of sectional rank. The larger is section Eusabatia composed of five groups of species which are classed as subsections. The smaller section, referred to as Pseudochironia, contains but two species. Subsections Difformes and Dodecandrae have been proposed.

The nomenclatural basis of all of the names applied within the genus has been investigated. This has resulted in the abandonment of four specific names of long continued usage. Sabatia elliottii Steud. is treated as a later synonym of S. brevifolia Raf. Sabatia capitata (Raf.) Blake has been rejected for S. boykinii A. Gray since Rafinesque's name, the earliest applied to the plant, was illegitimate and hence not available for transfer. A new name, S. quadrangula Wilbur, has been provided for the annual that has been called S. paniculata (Michx.) Pursh. The specimen upon which that name rests is the perennial called S. difformis (L.) Druce. The species formerly passing as S. decandra (Walt.) Harper has been renamed S. bartramii Wilbur since the identity of the plant upon which the original description was based is in considerable doubt and had best be treated as a nomen dubium.

The relationship of Sabatia to the other genera of the Gentianaceae and especially to those of the subtribe

Erythraeinae cannot be satisfactorily discussed prior to a reevaluation of the generic limits and the past attempts at phyletic classification in the family. Sabatia has been most commonly related to Centaurium from which it is amply distinct.

Intrageneric relationships are indicated where present. Those suggested are at the species level; it is not now possible to present a convincing explanation of sectional and subsectional relationships.

The distribution of the nineteen species and varieties is discussed with particular attention to the paleogeography of the area upon which the entities are found. Analytical keys to the sections, subsections, species and varieties are presented. Descriptions of all taxa are provided. A distribution map of each entity is included.

ACKNOWLEDGEMENTS

I wish to express my appreciation to Dr. Rogers McVaugh for his advice and assistance while directing this investigation. I am also under great obligation to Professor H. H. Bartlett, Director of the Botanical Gardens of the University of Michigan, for an appointment as an assistant at the Botanical Gardens for the summer of 1950. This appointment, together with the generous loan of his own station wagon, made it possible for Mr. Grady L. Webster and myself to collect throughout the southeastern United States and provided me with the prized opportunity of observing in the field most of the species included in this study.

In the course of this study more than 6500 specimens from over thirty herbaria have been examined. I wish to express my deep appreciation to the curators of those herbaria for their cooperation in loaning this material. The abbreviations employed in the text in referring to these herbaria are those of Lanjouw and Stafleu (1952) and are as follows:

BRU Brown University, Providence, Rhode Island.

CHARL Charleston Museum, Charleston, South Carolina.

CU Cornell University, Ithaca, New York.

DENN Dennison University, Granville, Ohio.

DUKE Duke University, Durham, North Carolina.

F Chicago Natural History Museum, Chicago, Illinois.

FLAS Florida Agricultural Experiment Station, Gainesville, Florida.

GA University of Georgia, Athens, Georgia.

GH Gray Herbarium of Harvard University, Cambridge Massachusetts.

K Royal Botanical Gardens, Kew, Great Britain (Part of collection.).

KSC Kansas State College of Agriculture and Applied Science, Manhattan Kansas.

MICH University of Michigan, Ann Arbor, Michigan.

MO Missouri Botanical Garden, St. Louis, Missouri.

MT Université de Montréal, Montreal, Canada.

NA United States National Arboretum, Washington, D. C.

NCS North Carolina State College, Raleigh, North Carolina.

NCU University of North Carolina, Chapel Hill, North Carolina.

NO Tulane University, New Orleans, Louisiana.

NY New York Botanical Gardens, New York, New York.

OKL University of Oklahoma, Norman, Oklahoma.

OKLA Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma.

PENN University of Pennsylvania, Philadelphia, Pennsylvania.

RUT Rutgers University, New Brunswick, New Jersey.

SMU Southern Methodist University, Dallas, Texas.

TAES Agricultural and Mechanical College of Texas, College Station, Texas.

TENN University of Tennessee, Knoxville, Tennessee.

TEX University of Texas, Austin, Texas.

UARK University of Arkansas, Fayetteville, Arkansas.

UC University of California, Berkeley, California. (Mexican specimens only.)

US United States National Herbarium, Smithsonian Institution, Washington, D. C.

WIS University of Wisconsin, Madison, Wisconsin.

WVA West Virginia University, Morgantown, West Virginia.

YU Yale University, New Haven, Connecticut.

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INTRODUCTION

Sabatia, a genus belonging to the Gentianaceae, is composed of seventeen species and two varieties. It is rather frequently encountered throughout much of its range, which extends from the margins of ponds and streams in Nova Scotia south as far as the savannas of western Cuba and the Mesa Central of Mexico, and from the Atlantic seaboard westward to the prairies of Oklahoma and central Texas. This group of plants has not been monographically treated since the time of Grisebach (1845), although it has been subject to numerous regional interpretations. The inherent attractiveness of these plants is assurance that an investigator will find available a better representation of this genus in the herbaria than for almost any other group of eastern North American plants.

HISTORY OF THE GENUS

Species now considered to belong to the genus Sabatia were first brought to the attention of the scientific world by the description of two of them as species of Gentiana in J. F. Gronovius' "Flora Virginica" (1739). This classic was based upon specimens collected by John Clayton, who served for over fifty years as clerk of the court of Gloucester County in Virginia. He sent duplicates and also notes to Gronovius in Leiden. Linnaeus was in Holland at the time Gronovius was studying the Virginian collection and his assistance is acknowledged in the preface of the Flora.

Linnaeus, then, was personally familiar with the specimens upon which Gronovian polynomials were based. He provided binomials for both of the Gronovian names now included in Sabatia in "Species Plantarum" (1753). In addition to the two species originally described in "Flora Virginica," two other species were characterized there by Linnaeus for the first time. These were based upon specimens collected by Pehr Kalm "in Virginia" and "in Canada." Both the two new species and one of those from Gronovius' work were first placed by Linnaeus in the genus Chironia together with four very different species from the Old World. The other species, based upon a Gronovian polynomial that now proves to be a Sabatia, was assigned by Linnaeus to the genus Swertia.

Adanson (1763) in "Familles des Plantes," resisting what seemed to him to be excessive generic "lumping" on the part of Linnaeus, recognized many pre-Linnean genera and initiated some new ones as well. Sabatia, one of the latter, was entirely based upon "Gentiana Gron. virg 29" which Linnaeus had previously called Chironia dodecandra.

This generic name was invariably spelled Sabbatia throughout the nineteenth century and by some authors even up to the present time. The change from the original spelling was presumably made and maintained because of the name of Liberato Sabbati, in whose honor the genus was proposed. Sabbati earned Adanson's approbation by the publication of "Synopsis plantarum quae in solo Romano luxuriantur" in 1745. The generic name Sabatia appears twice in the "Familles des Plantes" in addition to being listed in the index and is invariably spelled with a single "b." In Adanson's "Table cronologike des Auteurs de Botanike" (Fam. Pl. 1:27.) however, as well as in the index of that volume, the name of the Italian botanist is always Sabbati. One can therefore only conclude that Adanson deliberately chose to spell the generic name as Sabatia and his choice in this matter is binding (Art. 70. Int. Rules Bot. Nomen.).

Linnaeus, after transferring in 1767 one of the species formerly placed by him in Chironia (the one that also happened to be the type of Sabatia) to the resurrected Chlora of Adanson, placed the four species known to him now included in Sabatia in three different genera—Chironia, Swertia, and Chlora.

Salisbury (1806) took up the generic name Sabatia (as Sabbatia, thus initiating this orthographic form) and made the first combination within the genus. Pursh (1814) also accepted Adanson's genus and defined it to include all of the American species which had been placed by most earlier authors in the genus Chironia. He may be credited with having firmly established the present concept of the genus in American botanical literature.

Elliott (1817), in addition to publishing several new species, introduced considerable nomenclatural confusion that persisted for many years. The influence of Elliott's Sketch is clearly shown by Nuttall's Genera (1818).

Rafinesque proposed nearly thirty species or at least names (mostly without descriptions) during the first four decades of the nineteenth century. The identity of the majority of these names, even those with brief descriptions, will almost certainly remain a mystery. Two separate genera were also proposed by him.

Grisebach (1839, 1845) presented accounts of the genus in his treatments of the Gentianaceae. These two works are very similar in regard to the species of Sabatia. S. gentianoides Ell., which in "Genera et Species Gentianearum" was thought to represent a monotypic section was considered to form the monotypic genus Lapithea in the account presented in the Prodromus. Grisebach even placed this genus in a different subtribe from that including Sabatia. Eleven species and one variety were recognized by him.

Asa Gray's mark upon the genus was made by the

proposal of a few new entities, nomenclatural realignments, influence upon Chapman and the various editions of his own Manual. His understanding of those species found within the United States was finally crystallized in his treatment of the genus in the "Synoptical Flora" (1878). There he recognized thirteen species and two varieties. Gray did not follow Bentham (1873) who, in the "Genera Plantarum," had accepted Grisebach's genus Lapithea. Gilg's treatment (1895) of the Gentianaceae in "Die Natürlichen Pflanzenfamilien" also recognized Lapithea as of generic rank and in this opinion Small (1903, 1933) concurred.

Blake (1915) discussed the nomenclature of several of the species, made two nomenclatural combinations and provided a formalized system of classification by dividing the genus into named subgenera, sections and subsections. This arrangement was in large part merely the application of subgeneric names and validating diagnoses to the groups of species that long had been associated together under the synoptical key of the various editions of Gray's Manual from 1848 through 1907, the "Synoptical Flora" (1878) and the indented key of Small's Flora (1903). The twenty-two species and the one variety accepted by Blake were arranged by him as follows:

Subg. I. Eusabatia (Griseb.) Blake

Sect. 1. Pentapetala Blake

Subsect. A. Angulares Blake

1. S. macrophylla Hook.
2. S. angularis (L.) Pursh
3. S. difformis (L.) Druce

4. S. paniculata (Michx.) Pursh
5. S. brachiata Ell.

Subsect. B. Campanulatae Blake

6. S. Elliottii Steud.
7. S. stellaris Pursh
8. S. campanulata (L.) Britton
8b. S. campanulata var. grandiflora (Gray) Blake
9. S. simulata Britt.
10. S. Purpusii Brandegee
11. S. Palmeri Gray
12. S. maculata (Benth.) B. & H.
13. S. calycina (Lam.) Heller

Subsect. C. Campestres Blake

14. S. campestris Nutt.
15. S. carnosa Small
16. S. arenicola Greenman

Sect. Pleienta (Raf.) Blake

17. S. foliosa Fernald
18. S. obtusata Blake
19. S. dodecandra (L.) BSP.
20. S. decandra (Walt.) Harper

Subg. II. Pseudochironia (Griseb.) Blake

21. S. gentianoides Ell.
22. S. capitata (Raf.) Blake

GENERIC RELATIONSHIP

The relationship of the genus Sabatia with the other genera belonging to the Gentianaceae is, of course, of considerable interest. It is, however, a problem which cannot be reasonably solved until a considerable amount of additional information throughout the entire family has been accumulated. A comparison of the arrangement of the genera proposed by Grisebach (1839, 1845), Bentham (1873) and Gilg (1895) shows a surprising amount of disagreement as to generic affinities and even as to what characters are of fundamental value in determining relationship. For example, Grisebach first treated Sabatia gentianoides as a monotypic section of the genus Sabatia, but later thought it worthy of generic rank and even placed it in another subtribe from that to which the other species of Sabatia were assigned. Bentham and Gilg, however, although accepting Lapithea as of generic rank, did not place it in a different tribe or subtribe from that of Sabatia. Gilg's estimate of Bentham's arrangement is not at all flattering for he states that the diagnostic characteristics forming the entire basis of Bentham's system are not correctly applied to almost half of the genera and species which they supposedly describe. ("Bei manchen der Bentham-Hooker'schen Gruppen trift kaum für die Hälfte der Gattungen and Arten die Gruppendefinition zu.")

Examples of the difficulties encountered in any attempt to collate from the literature significant information presented by those who have had the most experience with the family may illustrate the futility of speculation until more is learned of the group. Both Bentham and Gilg considered the Exaceae (or Exacinae) to be the most primitive group of genera in the Gentianaceae in that the included genera possessed biloculatar ovaries. In addition to the genera which both included in that group, Bentham assigned to it Tachiadenus Griseb. whereas Gilg placed that genus in the highly advanced Tachinae. Lindsey (1940), after comparing anatomically the floral morphology of a majority of the genera of the Gentianaceae, concluded that "placental form and vascularization points to the origin of bilocularity in the family by progressive protrusion and fusion of placentae." The septum of these bilocular genera is apparently entirely placental in composition. The ventral traces are at all times found at the suture of the carpel and never within the partition as would be expected if this were the primitive, rather than the derived, two-celled type. Lindsey adds that the heavy emphasis attached to the number of locules in the ovary is unwarranted as "from a morphological standpoint it is apparent that a phylogenetic or even ontogenetic change from the unilocular to bilocular or vice versa is by no means drastic in view of the highly plastic placentae in the Gentianaceae." Furthermore that investigator was of the opinion that the "parietal type of placentation seems to be the most primitive one in the Gentianaceae, the axial type

being derived from it by elaboration and fusion of the placental flanges." Lindsey found a strong tendency towards bilocular ovaries or their actual occurrence in several other tribes or subtribes. The Erythraeinae, the subtribe to which Sabatia has been assigned, rather than the Exacinae was considered by Lindsey to be the most primitive group of genera within the family. Sabatia is, however, not one of the most primitive genera in that subtribe, for its fused calycine laterals and the intrusion of the placentae into the locule are evidence of a more advanced condition.

Zygostigma Griseb., whose type species was originally described as a species of Sabatia, was placed by Bentham in close proximity to the latter genus. Gilg assigned it to a different subtribe.

Ewan (1948) has briefly discussed the obscurement of generic affinities in the treatment of the family in the "Pflanzenfamilien" resulting from Gilg's almost complete reliance upon pollen characteristics as an indication of relationship.

Another example of the uncertain state of our knowledge of intergeneric relationship within the Gentianaceae is shown by the varying disposition of the genera Bartonia Muhl. and Obolaria L. Gilg, relying upon characteristics of the pollen, placed these two North American genera in the Erythraeinae. Lindsey (1940) concluded the the "position of Bartonia and Obolaria in the Erythraeinae may be questioned, in view of the affinities with the Gentianinae." His evidence was based upon the occurrence of the ovules over

practically the entire surface of the carpellary wall--a characteristic of most of the Gentianinae but otherwise totally unknown in Gilg's Erythraeinae. The placentae of this last mentioned tribe are restricted to the region of the sutures or borne upon protruding margins of the carpels. Bentham had previously associated both Bartonia and Obolaria with the group of genera to which Gentiana and Swertia belong (the subtribe Gentianinae of Gilg) using this same criterion.

Huxley (1887) presented what is no doubt one of the most interesting attempts to arrange the genera phyletically. The study was admittedly rather superficial and restricted itself for the most part to modifications of the corolla and the arrangement of the nectaries. The substance of his paper was that evolution was marked in the Gentianaceae by increasing complexity or at least effectiveness in the

> ...gradual interposition of more and more obstacles in the way of easy access to the nectaries. Yet these obstacles, whether they arise out of a mere narrowing and elongation of the tube of the corolla ...or out of the development of fimbriae and pectines ...or of interlobes, synanthery, and discoidal stigmata...are always of such a nature that they afford no effectual hindrance to the passage of a thin flexible organ, like the haustorium of a suctorial insect, but only just sufficient obstacle to make the insect an efficient agent in cross-fertilization.

Huxley found that the variations of the corolla observed by him within the family could be arranged in eight different classes with strong indication as to their interrelationships. Admitting that this study was but a beginning, he expressed a strong desire that it be continued by others. So far as I can determine the suggestion of this famous

zoologist has received little or no response. Perhaps botanical systematists have been disuaded from seriously considering Huxley's hypothesis by such statements as the following:

> If Frasera and Swertia are to be regarded as generically distinct from Gentiana, I fail to see on what principle G. amarella and G. purpurea, which differ at least as much from one another as Swertia, Frasera, and Gentiana do, can be grouped into one genus. Considerations of this kind, which might be multiplied indefinitely, obviously suggest a thorough revision of the Order...

Sabatia was associated in Gilg's arrangement in the tribe Gentianeae, subtribe Erythraeinae together with fifteen other genera (excluding Bartonia and Obolaria). Most of those genera are small, often of but a very few species; about half of them are known only from the Old World. None of them seems at all closely related to Sabatia. This genus has been placed most often near Centaurium Hill (= Erythraea Borkh.) from which it may be easily separated by several characters; but since the two genera can be otherwise distinguished at a glance, these key features are seldom employed. They are as follows:

Stigma deeply 2-lobed, the lobes at least one-third the length of the style, at first twisted spirally about one another but uncoiling and spreading apart at maturity; anthers becoming circinnately coiled or recurved or but half twisted laterally after pollen discharge. . . . . SABATIA

Stigma capitate or but barely creased, the divisions scarcely discernible, position unchanging with

age; anthers becoming tightly spirally coiled in the manner of a cork-screw after pollen discharge. . . . . CENTAURIUM

Any worth-while discussion of the generic affinities of Sabatia must of necessity await a complete review of the entire Gentianaceae, a task urgently deserving attention but one that is considerably beyond the scope of this paper.

INTRAGENERIC RELATIONSHIP

The seventeen species of Sabatia recognized in this treatment fall naturally into six groups of unequal size. The relationship of these subgeneric units to one another is not readily interpreted but some of them are clearly more strongly differentiated from their congeners than are others.

Glands, nectaries, squamellae, pectines, fimbriae, plaits, fulveolae, spurs and numerous other modifications or appendages so characteristic and so variable in other genera of the family are absent in Sabatia. Their lack yields a flower of relative simplicity and greatly reduces the opportunity for the expression of floral variation. The vegetative simplicity of the genus is such that in comparison to genera of most other families, Sabatia possesses a much smaller number of features in which variation might be apparent. The absence of indument of any sort on any part of the plant and the unvaryingly entire leaf margin alone greatly limit the possibilities of variation.

Perhaps the most fundamental difference appearing within the genus is the variation between anthers at maturity and during and after pollen discharge. The anthers of fifteen of the species recurve longitudinally from the tip downward during discharge and the empty anther is circinnately coiled to a varying extent depending upon the species.

This is in striking contrast to the behavior of the anthers of the other two species which are slightly quarter to half-twisted laterally even prior to pollen discharge and which change little or not at all thereafter. This variation certainly seems trivial and I am not familiar with the anatomical modifications that control it. They are probably of slight magnitude. Only those species with laterally twisted anthers possess sessile to subsessile flowers arranged in few- to several-flowered heads closely associated with large leaf-like bracts. In addition the two species belonging to the smaller group (i.e., that with laterally twisted anthers) are annuals possessing plurimerous flowers --a combination unique for the genus. The differences between these two groups of species have been known for more than a hundred years and botanists have accorded to these units different ranks. Grisebach (1839) first considered them sections but six years later not only thought them to be of generic rank but even placed them in different subtribes. Bentham (1873), Gilg (1895) and Small (1903, 1933) also considered the two groups to be of generic rank. Blake (1915) thought the differences merited the rank of subgenus. I am treating them as sections, in accord with the original estimate of their relationship and degree of divergence from one another, more out of nomenclatural convenience than because of any absolute conviction in the matter. As is shown by its greatly reduced or modified foliage and bracts, S. gentianoides is a derived type from either S. boykinii or from a similar precursor of that species.

The second important morphological discontinuity in the genus is more difficult to determine. Blake (1915) considered plurimerous flowers as contrasted with pentamerous flowers to be indicative of a major break within the genus and ranked as sections the two groups thus formed. The number of flower parts is somewhat more variable than Blake recognized. S. calycina, one of the species placed by him in the typically pentamerous section, appears to me to be more closely related to the plurimerous species. In addition to the strong tendency for the flower parts to be more numerous than five, S. calycina possesses an elongate rhizome and an over-all aspect which is strongly reminiscent of the pluripetalous species and not at all like those plants with which it formerly has been associated. In this regard this species serves somewhat as a transitional one between the "pentamerous" and the "plurimerous" groups--lessening or obscuring the importance of the distinction between the two. The pluripetalous group (including S. calycina), hereafter referred to as Dodecandrae, possesses elongate rhizomes, a characteristic of only one other species group with which it is only very remotely related. A group of four species, including S. dodedandra, is perhaps the most distinctive unit among those with recurving, rather than laterally twisting, anthers. In this treatment it is accorded subsectional rank and thus nomenclaturally is considered as evolutionally on the same level with the four other subsections comprising section Eusabatia. This is almost certainly not true but it is impossible to do more than approximate the evolutionary

levels encountered in a practical system of classification.

The next most strongly distinguished unit, subsection Difformes, is characterized by elongate thick rhizomes, opposite branches and white flowers. Its two species, although formerly included within the Angulares, form a very distinctive unit whose relationship with the other subsections is certainly remote. Within this subsection variation of the calyx lobes, cross-sectional shape of the stem, and presence or absence of a glaucous bloom are of diagnostic importance.

The opposite-branching pattern and rosulate nature together with an annual habit set the three species of the Angulares off from their congeners. Cross-sectional shape of the lower portion of the stem, leaf shape, pedicel length, and to some extent flower color are specific criteria within this subsection. In the past these plants have been most often referred to as biennials. The response of a few plants of S. angularis grown in the green house is that of an annual and I believe that the species belonging to this subsection willprove to be so. It still, however, remains a question that needs investigation.

The Campestres are a distinctive subsection of only two species. Their strongest feature is that the turbinate calycine tube bears conspicuous and highly developed costae formed by the fused lateral traces of the calyx. These costae bear thin, but conspicuous membranous wings. The plants are annuals and the branching pattern is at least in the upper part of the stem typically alternate. S. arenicola

Greenm., found only in close proximity to the seashore, is believed to be a species derived from the related plant of the prairies, S. campestris Nutt.

Subsection Campanulatae is composed of three annuals and one perennial and is thus the only species group showing diversity in life-form. The branching pattern in this group is typically alternate, but this characteristic is highly variable, as it is throughout most of the genus. The leaves are usually narrowly linear to filiform. This subsection is not set off by one strong characteristic or evey by a series of lesser ones. It seems to be the residue remaining after the better characterized elements have been removed. Segregation of the annuals, leaving S. campanulata to form a monotypic subsection characterized by its more or less shortly branched, erect, caespitose caudices (a feature unique in the genus), would result in two subsections, each certainly more homogeneous than the present one. Such a procedure has much to recommend it. For the moment at least, I am hesitant about erecting additional subgeneric units as their utility and purpose is defeated when they become so numerous as to be monotypes or ditypes. The genus is already, for one so small, burdened with a formidable subgeneric classification. The dismemberment of the Campanulatae is, however, the next natural break within the genus. The annual species seem rather closely related.

The perennial habit is found in all of the species belonging to two of the subsections of the presumably more primitive section, Eusabatia. It is also a feature of one

species of the Campanulatae. It is of interest, but not surprising, to find that the perennial species are more or less restricted to marshes, bogs, savannas and similar habitats, exactly the environment where perennials form an overwhelming majority of the flora. The annuals are more characteristically the inhabitants of dry, open, pine and oak woods, fields, prairies, beaches or sandy places.

A hypothetical ancestor of these six species groups cannot be reconstructed or described with any assurance. Whether this ancestor was perennial or annual is uncertain. Although it is usually agreed that the perennial habit is more primitive than the annual, this is by a generalization and should not be applied to a particular case dogmatically. Opposite branching is probably a primitive feature in opposite-leaved genera and the alternate pattern is derived from it by abortion. The pentamerous floral condition is almost certainly primitive in the Gentianaceae and the plurimerous condition is hence derived. Pink or roseate flowers are probably the more primitive throughout the genus. Subsection Difformes is perhaps the most primitive of the species groups judging from its perennial habit (assuming that annuals in this genus are derived), opposite-branching, and pentamerous flowers. Its flowers are, however, white. Since the relationship between the six recognized species groups is so obscure, the assumption made is that they have had a long existence as distinct units.

SYNOPSIS OF THE PRESENT TREATMENT

Sect. I. EUSABATIA Griseb.

Subsect. A. Difformes Wilbur

1. S. difformis (L.) Druce
2. S. macrophylla Hook. var. macrophylla
2b. S. macrophylla Hook. var. recurvans (Small) Wilbur

Subsect. B. Angulares Blake

3. S. angularis (L.) Pursh
4. S. quadrangula Wilbur
5. S. brachiata Ell.

Subsect. C. Campestres Blake

6. S campestris Nutt.
7. S. arenicola Greenm.

Subsect D. Campanulatae Blake

8. S.campanulata (L.) Torr.
9. S. stellaris Pursh
10. S. grandiflora (A. Gray) Small
11. S. brevifolia Raf.

Subsect. E. Dodecandrae Wilbur

12. S. calycina (Lam.) Heller
13. S. dodecandra (L.) B.S.P. var. dodecandra
13b. S. dodecandra (L.) B.S.P. var. foliosa (Fern.) Wilbur
14. S. kennedyana Fern.
15. S. bartramii Wilbur

Sect. II. PSEUDOCHIRONIA Griseb

16. S. boykinii A. Gray
17. S. gentianoides Ell.

GEOGRAPHIC DISTRIBUTION

The genus Sabatia is restricted in distribution to continental North America and the West Indies. All of the entities here recognized are to be found in the southeastern United States. The distribution of most of them is either entirely restricted to that area or is largely centered there. Florida and Georgia each possess fourteen of the nineteen recognized entities, and the Carolinas are each represented by more than ten species or varieties. The majority of the entities is either found in or is entirely restricted to the Coastal Plain, the oldest portions of which have been available to the occupancy of plants only since the close of the Cretaceous.

This genus is believed to be an ancient one, whose intrageneric divisions appear to have been clear-cut and well-defined for a long period of time. Even the species seem, in most instances, to be genetically so well isolated from their closest relatives as to show no indication of hybridization even when flowering in close proximity. These are almost certainly indications of great age.

The regions within the range of the genus that apparently have been available for plant occupancy for the longest period of time, at least since the close of the Paleozoic, and which are therefore older than the angiosperms

themselves, are the extensive land masses centered about the southern Appalachian and Ozarkian areas and that area about the Cordillera Central of the island of Haiti. The first two of these regions, commonly referred to as Appalachia and Ozarkia, have long been recognized as biological reservoirs from which a large part of the flora of eastern North America has been derived. For the past fifty years (see Kearney, 1900; or Fernald, 1931) it has been rather unanimously agreed that the floristic components of the Coastal Plain of the southeastern states have in large part been drawn from the Appalachian region.

Early in the Cenozoic era Appalachia was undergoing a series of uplifts which greatly reduced both topographically and climatically the available bog or savanna-like habitats that previously had been so abundant in that peneplained area. At approximately the same time that Appalachia was becoming a less favorable habitat for the plants that had thrived there during its base-leveled state, the uplift of two to three thousand feet that was eventually to re-elevate part of the peneplained area into the Appalachian Mountains was followed by the slow emergence of the continental shelf from beneath the epicontinental seas and the formation of the present Coastal Plain. Into this area of low relief moved the largely dispossessed elements of Appalachia. There they were joined by invaders from the tropics or subtropics by way of both Texas and Florida. The floristic element that was derived from Appalachia is often rather strongly indicated by the isolated colonies of whole groups of species

and genera in upland bogs and similar situations which are environmentally somewhat reminiscent of the base-leveled Appalachia of the early Cenozoic and later Mesozoic.

Ozarkia has also been available for plant occupancy for a period of time longer than the existence of flowering plants. The present distribution of the species of Sabatia and many other genera of a typically more mesophytic nature would indicate that Ozarkia had played a far less important part as a scene for the history of the genus than did Appalachia. The increasing aridity of the Ozarkian region throughout the Cenozoic may well account for this difference between these two ancient and sizable land masses. The only other Paleozoic surface upon which any species of Sabatia is known to occur is the small mountainous region of the central part of the island of Haiti.

Only one species of Sabatia is at the present time entirely restricted to any of these ancient regions and that is S. boykinii. This species is found only in northeastern Alabama, northwestern Georgia, southeastern Tennessee and southwestern North Carolina--all areas that have been available for the occupancy of plants from at least the close of the Paleozoic. S. boykinii and S. gentianoides form a very distinctive group within the genus and one that morphologically is the most strongly differentiated of all the species groups. S. gentianoides, restricted to the Coastal Plain except for one station at the outer periphery of the Piedmont, is believed to be more advanced than the endemic of the southeastern uplands.

Besides the endemic, S. boykinii, four other species are frequently found within the limits of Appalachia. These four species are S. angularis, S. quadrangula, S. brachiata, and S. campanulata. Ozarkia possesses but two species within its confines, namely S. campestris, and again S. angularis. The ancient Haitian area is occupied only by S. calycina. Other than these seven species all the others are found upon land which only became available for occupancy during the Tertiary.

The distribution of species within these ancient lands, which have been neither submerged beneath the sea nor covered by glacial ice at some time since at least the close of the Permian, might seem at first glance to be of some significance in explaining both the distribution and phylogeny of the other species. This, however, does not appear to be so. All the species of subsection Angulares are widespread upon at least one of these ancient lands. They are also commonly present upon the Coastal Plain and one species occurs in the formerly glaciated regions. I am assuming, but certainly have not proved, that these three species originated in one of these refugia (probably Appalachia) and have attained their present range by migration onto the younger sediments. It should be pointed out that the annual habit and successful completion of the life-history of these plants in dry, open woods, meadows, or even rather weedy situations provides the members of subsection Angulares with what is no doubt a great advantage for successful existence in either Appalachia or Ozarkia in comparison with

the often edaphically restricted species of the Coastal Plain. S. angularis is abundant in both Appalachia and Ozarkia, but S. quadrangula and S. brachiata are found only in Appalachia and in more recently available areas.

S. campestris is found in great abundance throughout most of the Ozarkian reservoir and its area extends considerably, especially to the south beyond that region. S. campanulata is found in numerous upland bogs throughout Appalachia and is the only perennial to be found in either of these large and ancient biological refuges. S. calycina is the only species found in the only area in the West Indies that has had a comparably long period of availability for plant occupancy.

Seven species, then, are to be found with some frequency within one or more of these refugia. The remaining twelve entities are distributed somewhat in the form of an arc about the southern and eastern borders of Appalachia and Ozarkia.

Woodson (1947) strongly advocated the important role played by still another ancient land besides Appalachia and Ozarkia whose significance has perhaps been greatly underestimated in the past. That author was greatly impressed with the importance of this area, often called Orange or Oligocene Island, in providing an explanation for the present distribution of the genus Asclepias in eastern North America, the high percentage of endemism of milkweeds in and about Florida in particular, and that of the flora of Florida in general. Camp (1941), St. John (1935) and

Schornherst (1943) are additional investigators who believed that this refuge in one form or another would help explain the distributional patterns within different groups of plants. Stratigraphic evidence (see Schuchert, 1935) apparently confirms the evidence throughout the Oligocene of an archipelago of varying size in what is now peninsular Florida. In Miocene times the island or islands became connected with the mainland. This would allow an insular history of about twelve million years. Woodson, however, felt that the biological evidence was such as to argue for an even longer existence than that supported by present structural information. In his opinion this refuge may well have existed as far back as the Paleozoic. The hypothesis of Orange Island having been an ancient refuge and one of the principal centers of differentiation in eastern North America appears at first glance most promising and certainly deserves critical evaluation in the future. In part this may be provided by testing this hypothesis, apparently so strongly supported by the ranges of the asclepiads east of the 100th meridian, with the distribution patterns of many other groups of plants. Within the genus Asclepias, studied by Woodson, 27 per cent of the species found in Appalachia were endemic as compared with 58 per cent of those in Ozarkia and the even higher proportion of 80 per cent in Orange Island.

Schornherst (1943) arrived at the following conclusions bearing upon the importance of Orange Island as a result of her study of the phytogeographic affinities of the mosses

of northern Florida: (a) "The Oligocene Island in central Florida has served as a reservoir of tropical species which migrated northward under favorable conditions" and (b) that those "tropical species occurring in northern Florida but absent from southern peninsular Florida are considered as relicts of a once widespread tropical flora."

St. John (1935) was impressed by the "presence of a remarkable group of endemic species" of ferns and in addition by the fact that "a considerable number of tropical species are represented in the United States only by their presence in this region (Orange Island) which is not tropical."

McVaugh's treatment (1936) of the eastern North American species of Lobelia provides a sizable group which may be utilized for further evaluation of the concept of three refugia. Of the twenty-seven species and varieties then recognized by McVaugh, one-third are probably to be attributed to the Appalachia type of distribution while another third is apparently of the Orange Island pattern. Three more of the entities (one-ninth of the total) apparently used Ozarkia as a refuge. Four more species or varieties would seem to owe their present distribution to having spread from both Ozarkia and Appalachia. The remaining two species are almost completely restricted to glaciated country and at the time of publication of that paper McVaugh favored "survival within the glaciated area, rather than south of it" as the best explanation of the distribution of both L. kalmii and L. dortmanna. The putative refugia of the eastern North American lobelias may be summarized as being one-third Appalachia,

one-third Orange Island, one-ninth Ozarkia, four/twenty-sevenths both Appalachia and Ozarkia, and the final two/twenty-sevenths as boreal relicts.

The possibility of error in identifying the true Orange Island element as opposed to those species which merely simulate it, having in reality migrated from Appalachia and having been completely eliminated in their former home, is recognized by Woodson. This is particularly true for those species believed to be of Orange Island origin which have completely disappeared from their presumed Tertiary refuge and are now found varying distances from it along the Gulf or Atlantic Coastal Plain. Examples of this last type are Asclepias rubra L., Lobelia elongata Small, L. brevifolia Nutt., L. boykinii T. & G., L. flaccidifolia Small (including L. halei Small) and L. floridana Chapman. To this list L. canbyi Gray could be added except for its occurrence in the "barrens" of Tennessee and possibly in the Piedmont of North Carolina. Elimination or ignorance of these stations of L. canbyi in Appalachia would doubtless result in the assigning of that species to the Orange Island refuge. Its absence from peninsular Florida would then be explained as the result of migration along the Coastal Plain and extinction within its old refugium. L. boykinii has a rather similar range but as it apparently merely approaches the Appalachian refuge along the Fall Line, it would be considered an Orange Island type.

McVaugh's (1936, p. 256) conclusions in regard to the distribution of these species are "that from one or more

ancestral types living in the Appalachian region of the Southeastern United States, in Tertiary times or before, have come a majority of the species of Lobelia now native in this region" and "that these changes have been brought about by the natural radial spread of the original species, so that closely related plants are seen to be occupying different radii of the same hypothetical circle." Wherry (1935) had previously suggested a similar explanation for the present distribution of the species of Sarracenia.

Returning to the distribution of Sabatia one finds, after excluding those species found in areas exposed before the Mesozoic, twelve species and varieties distributed about the eastern and southern boundaries of Appalachia and Ozarkia.

S. arenicola is very obviously related to S. campestris and it is believed to have been derived from that species or from its immediate precursor. S. arenicola is at present known only from the Quaternary littoral deposits along the beaches from Louisiana to southern Tamaulipas. The fact that it is now found only upon the land surface that has been most recently been made available to plant occupancy does not provide us with any definite information as to the antiquity of the species. It is at least possible that the plant had evolved on any of the earlier shore lines and had merely migrated to the newly emerged beaches. Pennell (1935, p. 575) points out that "sea-coasts of some kind are as old as the continents themselves. It is to be expected that strictly coastal species will often prove very ancient, a

fact that seems confirmed by the wide occurrence over the Earth of many littoral sand and salt-marsh plants." S. campestris possibly evolved in Ozarkia and spread into the younger portions of Texas as it emerged from the sea during the Cenozoic. If its origin was during Tertiary times it could have arisen in that part of Texas south of Ozarkia that became available for plant occupancy in late Cretaceous times.

S. gentianoides is the only other species clearly related to species of the ancient biological reservoirs which have existed from at least the close of the Permian. S. boykinii and S. gentianoides together form a unique unit within the genus; the former is restricted to the southern Appalachians and the latter is a wide-spread Coastal Plain species. The present range of S. gentianoides is such that it very likely would be relegated to the Orange Island category which had largely, if not entirely, disappeared from its ancient refuge. It appears more likely, however, that this species either evolved in Appalachia and migrated to the Coastal Plain where it spread widely while disappearing from its homeland, or it evolved completely on the Coastal Plain from an ancestor very much like S. boykinii.

Three of the entities, S. difformis and the two varities which make up S. macrophylla are distributed in the manner of overlapping arcs to the east and south of Appalachia and are completely (or nearly) restricted to the Coastal Plain. S. difformis which is found rather abundantly

throughout much of Florida and northward at least as far as New Jersey would probably be considered an Orange Island type which had spread extensively northward along the Atlantic seaboard. S. macrophylla might also be considered as an Orange Island derivative which had differentiated into two varieties after migrating from its former refuge. Except that these entities are not known from any part of Appalachia (disregarding two stations barely within the Piedmont), they might all be attributed, with an equal degree of assurance, to that older refuge. Nevertheless, the latter explanation is here favored. The original population, which perhaps was polymorphic, migrated from Appalachia onto the Coastal Plain. The fragments of the original population that reached the new home continued to evolve and to spread laterally along the Coastal Plain. When they had reestablished partial contact with their close relatives, genetical and other barriers had presumably developed which functioned to maintain the identity of the evolved groups.

S. stellaris possesses both the greatest latitudinal and longitudinal range of any species within the genus and its distribution is certainly among the most perplexing. It is found throughout peninsular Florida although more common on or near the present coast line and is also found with considerable regularity along the coast as far north as the southern shore of Massachusetts and as far west as Louisiana. It is also rather abundant in the Bahamas, which are of late-Pleistocene age or even younger, and in the province of Pinar del Rio in western Cuba. In addition to

this pattern of distribution, which is rather conventional, specimens from the Mesa Central of Mexico are conspecific with the eastern plant. The Mesa Central according to Schuchert (1935, p. 124) was finally elevated above water for the last time by the withdrawal of the Mesozoic seas at the end of the Cretaceous. The Mexican representatives of this species occur on an older land mass than those plants within the principal range of the species. There for the most part they are found only in Pleistocene or post-Pleistocene deposits except in Florida where they are occasionally found in areas continually exposed since the Oligocene. The eastern distribution of the species would probably be considered of an Orange Island type except that the disjunct Mexican stations scarcely match that pattern. In the absence of factual information one is again reduced to speculation. Perhaps S. stellaris, like the eastern North American species of Gerardia, Cnidoscolus and many other genera, migrated into the Coastal Plain from Mexico by way of Texas in the later Tertiary. That species of Sabatia later disappeared from Texas. On the other hand, the eastern distribution of the species may be the result of migration or expansion from Orange Island and the Mexican stations may be relicts of an even older pattern of distribution.

S. grandiflora, apparently a close relative of S. stellaris, is clearly an Orange Island type, being at present restricted to peninsular Florida and to the province of Pinar del Rio in western Cuba.

S. brevifolia, again most nearly related to

S. stellaris, has also an Orange Island type of distribution. It is now distributed rather uniformly throughout inland Florida, except for the extreme southern tip, and has spread even farther beyond its presumed Tertiary refuge to the vicinity of Mobile in Alabama and northward approximately to Charleston, South Carolina.

Turning now to the four species that form subsection Dodecandrae, we again find the species arranged about the periphery of Appalachia. One of the species, S. calycina, has previously been mentioned as occurring in mountainous swamps on the ancient (at least Paleozoic) backbone of the island of Haiti. It is also known from the mountains of Oriente Province in Cuba. There it is not known from the oldest mountain range in Oriente, the Sierra Maestra, but from a central Oriente which, according to Schuchert, is at most of late Miocene age. The age of these mountains is in some dispute and may be greater than is admitted by him. In the United States this species is abundantly represented from throughout most of Florida and along the Coastal Plain westward as far as eastern Texas and northward into southeastern Virginia. The distribution is such that it would be classified as an Orange Island type except for the complexity introduced by the West Indian stations. At present it is impossible to state whether the West Indian stations were established from the United States or whether the West Indies supplied Orange Island with its initial stock which eventually spread along the Coastal Plain.

S. dodecandra is here considered to be composed of two varieties both of which are found only in the Coastal Plain. S. dodecandra var. dodecandra is largely restricted to brackish marshes and similar habitats along the coast from Connecticut to South Carolina. Apparently it is also known from two stations on the western shore of Florida. Inland extending from South Carolina through Louisiana S. dodecandra var. foliosa is to be found. Except for the one known station of this species on Tampa Bay, S. dodecandra sensu lat. has not been collected in peninsular Florida. With the existing information it would be most arbitrary to make a strong argument for either an Orange Island or Appalachian refuge for this species.

S. bartramii is an apparently excellent example of the Orange Island type of distribution. It is found throughout Florida, in southern Georgia and Alabama and is known from one station in southeastern Mississippi.

S. kennedyana possesses one of the most puzzling patterns of distribution of any of the species within the genus. Formerly it was believed to occur only within the glaciated territory, being then known only from Massachusetts, Rhode Island, and Nova Scotia. Its range is now known to include southeastern North Carolina and northeastern South Carolina. Fernald (1911) explained such distributional patterns as the result of post-Pleistocene migration along "a strip of sands and similar soils stretching with only slight interruptions from our South Atlantic coast to Newfoundland, and it is probable that not far in the wake of

the receding ice and the more boreal plants with the Newfoundland vole and the muskrat crossed on this sandy bridge to Newfoundland, though some other plants and animals which further south occur with them or to which they are closely related--Sabatia dodecandra [the species with which S. kennedyana was at that time united], Ilex glabra, etc., failed to cover the entire distance." Fernald went on to say that when "we consider the fact the bridge formed by the elevated coastal plain was composed of silicious soils presumably identical with those found upon the Coastal Plain of our present continent it is evident that the ideal route was laid out for the spread northeastward of the plants which prosper chiefly in such soils and it is easy to picture the Red Pine, Pinus resinosa, accompanied or soon followed by Schizaea pusilla, Corema Conradii, Hudsonia ericoides, and other southeastern plants of highly silicious regions, pushing successfully across the bridge to Newfoundland, while S. Dodecandra got as far as Sable Island and Ilex glabra reached the sandy swamps of Nova Scotia." St. John (Proc. Bost. Soc. Nat. Hist. 36:89. 1921.) has written that the report of Sabatia from Sable Island referred to by Fernald was actually a specimen of Centaurium. Later Fernald discovered the Sabatia in southern Nova Scotia.

Fernald's explanation of the presence of numerous Coastal Plain species in the flora of Nova Scotia and Newfoundland as being the result of migrations along the once emergent but now submerged continental shelf has not been

seriously challenged to my knowledge and is no doubt as good an explanation as can be provided at this time.

FUTURE INVESTIGATION

In view of the conclusion that the existing species of *Sabatia* represent geologically somewhat ancient types, which may occur in overlapping areas without forming intermediates by hybridization, it becomes obvious that they would provide fine material for an investigation of the nature of genetic or physiological barriers between them. There has been no time, however, to advance into the cytological and genetical study of the species. There is no difficulty in growing at least some of the annual species. Seeds were planted in the greenhouse and four of the six annual species planted flourished and flowered profusely. *S. angularis*, *S. arenicola*, *S. campestris*, and *S. stellaris* seem to be easily grown in the greenhouse in a light neutral loam. Seeds of *S. brachiata* and *S. quadrangula* were also planted but failed to develop. Few seeds, however, of these two species were available. It is expected that both of these species and all of the annuals of the *Campanulatae* can be readily grown in the greenhouse. Also, although seeds were not available, I believe that both species of section *Pseudochironia* can be readily grown for experimental work. A few seeds of *S. difformis* and *S. kennedyana* did not germinate; the quality of those seeds was questionable for they even failed to germinate upon moistened filter

paper. With these and all the other perennial species successful cultivation might be facilitated by the transfer of plants from the field.

The strongly developed proterandrous condition of all the species might prove advantageous in experimental cross-pollinations. S. arenicola and S. campestris would seem most promising for genetical study since both are readily cultivated. These two species are closely related and a few specimens have been observed which give rise to a suspicion that hybridization might occur naturally between them. Genetical studies involving S. stellaris and S. grandiflora would prove most enlightening. The former species is easily cultivated and S. grandiflora could probably also be easily grown in the greenhouse. Occasional specimens have been encountered in this species complex whose identities were decided only with considerable hesitancy, and they may have resulted from hybridization.

The affinities of both S. campanulata and S. calycina are or have been in question. Cytological investigation might aid in arriving at more definite conclusions.

The not-fully conclusive treatment of the polymorphic S. dodecandra can probably best be tested by extensive field observations and abundant collections.

SYSTEMATIC TREATMENT

SABATIA Adans.

Sabatia Adans., Fam. Pl. 2: 503. 1763.

Pleienta Raf., Fl. Tell. 3:30. 1837.

Neurola Raf., New Fl. 4: 92. 1838.

Erect, glabrous, annual or perennial herbs, arising from rhizome, almost invariably branched and often profusely so, with slender tap-root or cluster of fibrous roots; the perennials often stoloniferous. Leaves mostly cauline but basal leaves also present in some species, decussate (or in aberrant specimens whorled), entire, sessile or somewhat amplexicaul, membranous, or somewhat coriaceous, or succulent. Branches either opposite or alternate. Inflorescence cymose, the cymules either compactly subcapitately clustered or loosely arranged, being often reduced to one or two flowers, or compounded into showy dichasia. Flowers perfect, actinomorphic. Calyx 5--12(14)-parted, gamosepalous; the tube campanulate to somewhat turbinate, membranous; the lobes minute to foliaceous, varying in length from shorter than the calyx tube to many times longer. Corolla hypocrateriform, 5--12(14)-parted; the tube urceolate to cylindrical, short but equalling or more commonly exceeding the calyx tube; corolla lobes usually widely spreading,

dextrorsely contorted in bud. Stamens 5--12; filaments slender, inserted on the upper rim of the corolla throat, alternating with the corolla lobes, at first erect but strongly curving to one side after pollen discharge; anthers basally attached, linear to oblong, slender to stout, dehiscing laterally by means of longitudinal slits, after pollen discharge becoming either laterally twisted or circinnately recurved or revolute. Ovary bicarpellate, unilocular; carpel margins slightly intruding into locule and forming 4 parietally located placental lobes each bearing numerous scattered ovules. Style slender; stigmatic branches 2, linear to slightly spatulate, tightly spirally twisted at anthesis and bent to one side, later becoming erect, untwisting and exposing the densely papillate stigmatic surface. Capsule globose, ovoid, or cylindrical. Seeds numerous, globose, or somewhat flattened, completely pitted with small depressions.

TYPE SPECIES: Sabatia dodecandra (L.) B.S.P. (Chironia dodecandra L.).

KEY TO THE SECTIONS

I. Flowers usually long-pedicellate or, if short-pedicellate, the subtending bracts small and scale-like; flowers either solitary or loosely cymose; anthers becoming circinnately recurved after pollen discharge; plants, if annual pentapetalous, if perennial either pentapetalous or pluripetalous. . . . . I. EUSABATIA

II. Flowers sessile or very nearly so, the subtending bracts large and leaf-like; inflorescence of few to several closely associated flowers, appearing capitate; anthers slightly twisted laterally even prior to pollen discharge, never becoming circinnately recurved; plants annual and pluripetalous. . II. PSEUDOCHIRONIA

I. Section EUSABATIA Griseb.

Sect. Eusabbatia Griseb., Gen. et Sp. Gent. 120. 1839.

Subg. Eusabatia (Griseb.) Blake, Rhodora 17: 56. 1915.

Annuals or perennials. Flowers either pentamerous or plurimerous (only the perennials 7--12(14)-merous); typically long-pedicellate or at least not appearing to be sessile and capitately arranged with the cluster possessing large foliaceous bracts. Anthers becoming revolutely coiled or recurved after pollen discharge.

TYPE SPECIES: Sabatia dodecandra (L.) B.S.P.

This section is much larger than section Pseudochironia which is composed of only two species. The fifteen species belonging to the larger section show considerable diversity and they may be arranged readily into several groups of species (subsections) which are usually distinguished by several characteristics from each other. In contrast to the almost remarkable uniformity within the two species of sect. Pseudochironia, those of Eusabatia are strikingly variable and several of them have an

extensive synonymy to attest their diversity.

It is an extremely minor point but there is at least a doubt as to the orthography that is in accord with the Rules for the name of this section. As previously pointed out there is no justification under the Rules for changing the spelling of the generic name to Sabbatia as there is no evidence that Adanson in coining the botanical name did not deliberately omit a letter from the name of the botanist to whom it was dedicated. Later botanists merely changed the spelling of the generic name to satisfy their own preference that the name should conform in spelling to the name of the botanist commemorated by the genus.

> Art. 70. The original spelling of a name or epithet must be retained, except in the case of a typographical error, or of a clearly unintentional orthographic error.

This article contains nothing that would permit, let alone encourage, such a change as that of Eusabbatia to Eusabatia. Grisebach no doubt had every intention of spelling the sectional name just as it appeared. There is nothing in the Rules to prevent one from modifying or "improving" the spelling of a generic name when it is included as part of another name. I choose, however, to accept the spelling Eusabatia. It would seem most desirable to spell the name of the genus and its type section in a similar fashion when based upon the same name, as they are here. Sanction for this is found, at least in regard to familial names in the spelling of Amaranthaceae, Annonaceae, etc. (Int. Rules Bot. Nomon. Appendix II.). These families were originally

proposed with names based upon variant spellings of the name of the type genus.

KEY TO THE SUBSECTIONS

A. Calyx tube very prominently 5-nerved and thinly membranous-winged; pentamerous annuals. . C.) CAMPESTRES

A. Calyx tube smooth or finely nerved, lacking membranous wings; annual or perennial and either pentamerous or plurimerous.

B. Perennials with elongate rhizomes; some species stoloniferous; either pentamerous or plurimerous.

C. Branches typically opposite throughout; flowers mostly 5-parted, the centermost in the cymules occasionally 6-parted; corolla white and lacking yellow "eye" at base of lobes; pedicels less than 1 cm. long; stolons and basal rosettes never present. . . . . A. DIFFORMES

C. Branches typically alternate (at least the uppermost); flowers 5--12(14)-parted (3 species 7--14-parted, the other species 5--6(7)-parted); corolla typically pink or rose and with a yellow "eye" in throat and on base of lobes; pedicels mostly over 1 cm. long; stolons and basal rosettes present in some species. . . . . E. DODECANDRAE

B. Annuals or, if perennials, the caudex short and much-branched; stolons never present; flowers pentamerous.

D. Upper branches typically opposite; basal rosette present at some stage of life-cycle and often persistent. . . . . B. ANGULARES

D. Upper branches typically alternate; basal rosette absent; annuals or perennials . . . . . D. CAMPANULATAE

A. DIFFORMES subsect. nov.[1]

Robust perennials arising from a thick, gnarled, often much-branched, elongate rhizome bearing numerous fleshy roots about 2 mm. in diameter. Branches typically opposite. Leaves drying thick-chartaceous, margins revolute. Corolla white.

TYPE SPECIES: Sabatia difformis (L). Druce

The two species associated in this subsection are strongly differentiated morphologically from the annual species of subsection Angulares with which they were formerly

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[1] Subsectio Difformes. Herbae perennes; rhizomatibus crassis, contortis, saepe multiramosis radicibus carnosis ca. 2 mm. diam. Rami plerumque oppositi. Folia in speciminibus siccis crasse chartacea, marginibus revoluta. Corolla alba. Species typica, Sabatia difformis (L.) Druce (Swertia difformis L.).

placed. Including these perennials with the radically different species belonging to the Angulares would be placing undue emphasis upon the single character of an opposite-branching pattern that is typical of both groups while underestimating features such as the perennial habit and fleshy roots which seem to me to be of greater phyletic significance. The habitat occupied by the perennials is typically savannas and ditches, whereas the annuals of the Angulares are generally inhabitants of drier situations.

The three entities recognized as forming subsection Difformes are a conspicuous floristic feature of savannas or pine-barrens, or the marshy borders of low hardwood forests throughout their combined extensive range. These plants are, with the exception of a very few Piedmont stations at the outer margin of that province, entirely restricted to the Coastal Plain ranging from central New Jersey southward throughout much of peninsular Florida and westward into Louisiana. The three populations do not possess mutually exclusive areas but occupy ranges in the nature of overlapping arcs somewhat radially arranged about what may have been the ancestral home of the group, the ancient Appalachian land mass.

KEY TO THE SPECIES

A. Leaves and upper portion of the stem not glaucous; calyx lobes typically more than 4 mm. long and often 10 mm. longor longer; upper bractlets linear, those subtending complete (i.e., 3-flowered) cymules

4--5 mm. or more in length; corolla lobes almost invariably longer than 7 mm. and often up to 15 mm. and occasionally longer, their color often turning saffron or orange upon drying, especially along the veins; plants rarely taller than 9 dm. high; the main stem and branches becoming strongly angled or even quadrate above from 4 internodal ridges; ranging from central New Jersey southward and westward into western Florida . . . . . 1. S. difformis

A. Leaves and upper portion of the stem glaucous; calyx lobes rarely as long as 3 mm.; upper bractlets minutely scale-like, even those subtending complete cymules less than 3 mm. long; corolla lobes 4--7 mm. long, color remaining white or creamy-white upon drying; plants more robust, mostly taller than 9 dm.; the main stem and branches terete throughout, not becoming angled or quadrate; ranging from central Georgia and ne. Florida westward into Louisiana. . . . . 2. S. macrophylla

1. Sabatia difformis (L.) Druce

Swertia difformis L., Sp. Pl. 1: 226. 1753.

Chironia lanceolata Walt., Fl. Car. 95. 1788.

Chironia cymosa Lam., Tabl. Encyc. et Méth. Bot. 1: 479. 1791, not Burm., Fl. Cap. 5. 1768.

Chironia paniculata Michx., Fl. Bor.-Am. 1: 146. 1803.

Chironia venosa Muhl., Cat. Pl. Am. Sept. 24. 1813.

Sabbatia paniculata (Michx.) Pursh, Fl. Am. Sept. 1: 138. 1814.

Sabbatia paniculata α latifolia Pursh, l.c.

Sabbatia paniculata β augustifolia Pursh, l.c.

Sabbatia corymbosa Baldw. ex. Ell. Sk. Bot. S.C. & Ga. 1: 283. 1817.

Sabbatia corymbosa var. augustifolia Ell., l.c.

Sabbatia lanceolata [as lanceol.] [Walt.] Raf., Fl. Tell. 3:30. 1837, without basic synonym.

Sabbatia cymosa [Lam.] Raf., l.c., without basic synonym.

Sabbatia cymosa (Lam.) G. Don, Gen. Hist. 4: 207: 1838, as to basic synonym only.

Sabbatia lanceolata (Walt.) T. &. G., Man. ed. 1. 356. 1848.

Sabbatia difformis (L.) Druce, Bot Exch. Club & Soc. Brit. Is. 3: 423. 1914, as to basic synonym.

Perennial herb (25) 45--80 (105) cm. tall, 2--5 mm. in diameter, 1-several stems arising in a cluster from a stout, gnarled, branched rhizome 4--6 mm. in diameter. Stem stiffly erect, hollow, more or less terete below becoming

angular and sometimes almost quadrate above largely because of internodal ridges. Branches typically opposite, occasionally alternate at some nodes, ascendent at an angle of (10)20--40(50) degrees, generally restricted to the upper tenth or third of the stem, or less commonly in very robust plants branching almost throughout the entire length of the stem. Principal branches typically 3--4 times branched and together forming a compact, corymbose flat-topped to convex inflorescence. Numerous fleshy roots descending from the rhizome, these 8--12(20) cm. long, 1.5--3 mm. in diameter, usually bearing slender, fibrous, lateral roots. Leaves thick, firm, rather coriaceous when fresh, drying somewhat thick-chartaceous, venation obscure except for the rather prominently elevated midvein and often the lateral pair of veins, or in the broader-leaved types with 2 lateral pairs prominent. Basal rosette none; the lowermost cauline leaves borne submerged or subterranean, at time of flowering usually represented only by scars, when still present, often modified into appressed, obtuse, oblong bracts 2--3 cm. long. Upper cauline leaves strongly ascendent, linear to very narrowly lanceolate or even somewhat oblong or ovate-lanceolate to strongly ovate (especially in peninsular Florida), usually acute, rarely obtuse, somewhat revolute and both hyaline-margined and -tipped, usually rather strongly clasping, or merely sessile in the narrower-leaved types, (0.9) 1.8--4 (6.2) cm. long, (3) 4--14 (22) mm. wide, usually not more than twice exceeded by the internodes

and usually less; internodes occasionally 3--5-times or more longer than the nearby leaves. Pedicels slender, erect, finely ridged, 2--8 (15) mm. long. Calyx tube only slightly ridged, rather shallowly campanulate, crateriform or even turbinate, 1--2 (3) mm. long; calyx lobes linear to somewhat subulate, very slender, (2) 4--10 (14) mm. long, 2--8 (10) times the length of the tube, more or less outwardly arching at anthesis, erect in bud. Corolla tube narrowly cylindrical, (2.5) 3--5 (6) mm. long; corolla lobes typically 5, (the centermost flower of the central cymules often 6-parted), oblong, weakly spatulate, elliptic, obtuse to acute, wide-spreading, entirely white even at base, but often turning orange or saffron upon drying, especially along the veins. Filaments 2--3 mm. long, pale-yellowish to almost white, slender; anthers slender, lanceolate, bright-yellow, 2--3 mm. long. Style 2--5 mm. long; stigmatic lobes slender, linear, 2--5 mm. long. Capsule oblong-cylindrical, 4--8 mm. long, 2.5--4 mm. wide.

Type locality: "In Virginia." Type: Clayton 171 (British Museum); photograph of the type (GH!)

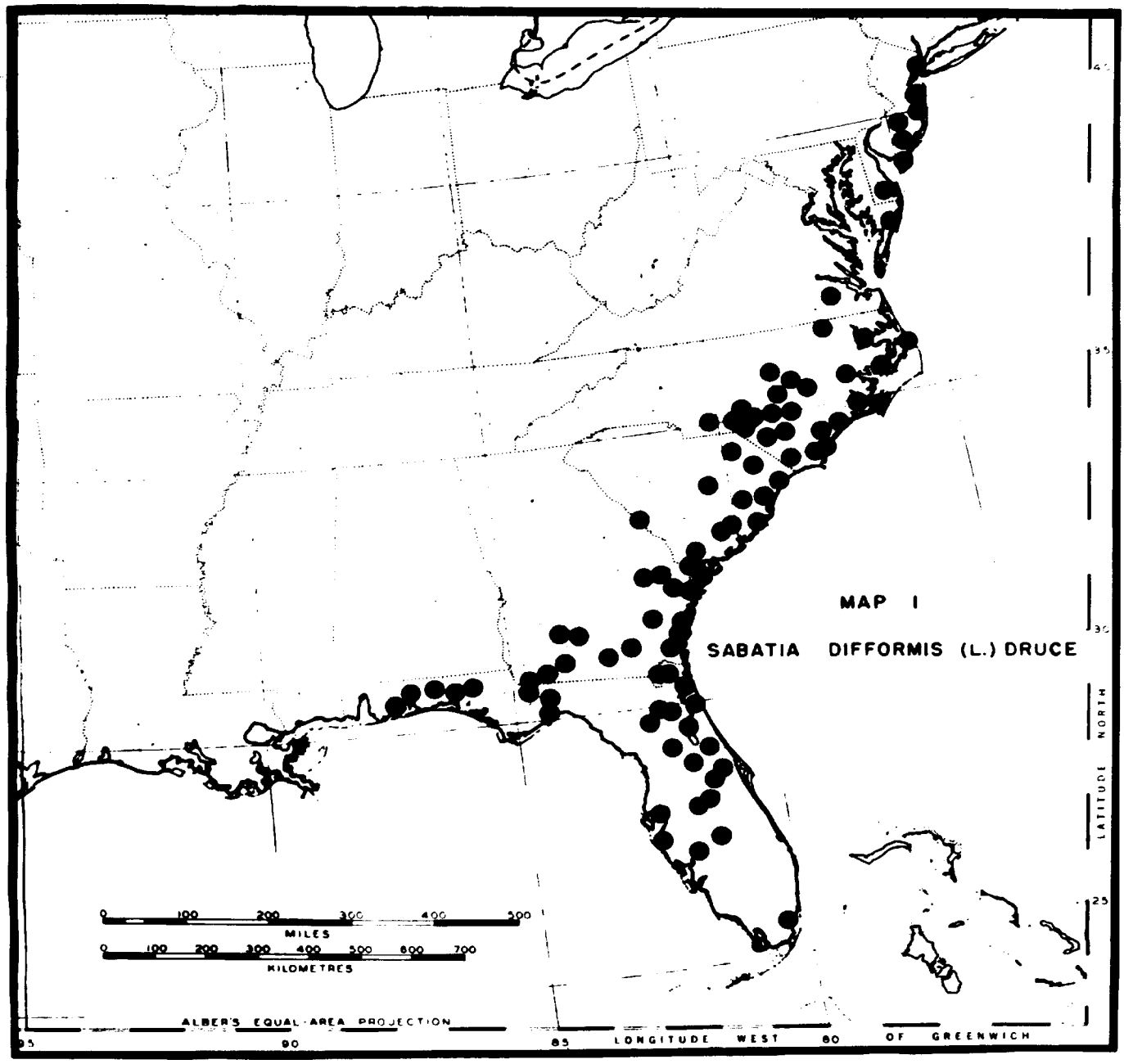
DISTRIBUTION: Savannas and pine-barrens along the Coastal Plain from (perhaps Long Island) central New Jersey southward and throughout peninsular Florida and westward into western Florida.

SPECIMENS EXAMINED.

NEW YORK: Nassau Co., Hempstead Flats, Mackaness 1937 (NO). Since no other specimen of this species has

MAP 1

Distribution of Sabatia difformis (L.) Druce


MAP 1
SABATIA DIFFORMIS (L.) DRUCE
0 100 200 300 400 500
MILES
0 100 200 300 400 500 600 700
KILOMETRES
ALBER'S EQUAL-AREA PROJECTION
95
90
85
LONGITUDE WEST
80
OF GREENWICH
LATITUDE NORTH
25

been seen or has been reported from the state and as the region is rather well-known botanically, verification of this record is highly desirable.

NEW JERSEY: Atlantic Co., Hammonton, Brinton 3 Aug. 1890 (F, MO, PENN); Burlington Co., about 1.5 mi. se. of Atsion, Fogg 5663 (F, GH, PENN); Cape May Co., Bennett, Gershoy 567 (CU, GH); Hudson Co., Jersey City, Martin (YU); Monmouth Co., collector and exact locality unknown 1842 (MO): Ocean Co., Toms River, Mackenzie 2774 (MO, US).

DELAWARE: Sussex Co., 0.5 miles west of Concord, Tatnall 3129 (GH).

MARYLAND: Worchester Co., Stockton, Rusby Aug. 1889 (NY).

VIRGINIA: Sussex Co., southwest of Wakefield, Fernald, Long & Clement 15340 (GH, MO, US).

NORTH CAROLINA: Anson Co., near Polkton, Correll 1039 (DUKE); Beaufort Co., near Chocowinity, Correll 1585 (DUKE); Bladen Co., 4 miles north of Elizabethtown, Wilbur 2900 (MICH); Brunswick Co., 8 miles west of Leeland, Wilbur 2884 (MICH); Carteret Co., near Atlantic, Hill 105 (DUKE); Chowan Co., Edenton, Godfrey 5343 (GH, US); Columbus Co., Old Dock, Godfrey & Shunk 4204 (GH, US); Craven Co., between Newport and New Bern, Blomquist 11250 (DUKE); Cumberland Co., near Fayetteville, Biltmore Herb. 1387h (OKLA);

Dare Co., 1 mile s. of Manteo, Fox 4122 (MICH, NCS); Harnett Co., 3 miles southeast of Dunn, Wilbur 2897 (MICH); Hoke Co., without exact locality, Schallert 4 July 1940 (GH, MO, UARK, WIS); Johnson Co., near Selma, Biltmore Herb. 1387f (NY); Moore Co., 4 miles southwest of Pinebluff, Wiegand & Manning 2552 (CU); New Hanover Co., Carolina Beach, Godfrey Pl. Ex. Gr. 974 (F, GA, GH, MICH, MO, MT, NCS, NCU, NY, OKL, PENN, SMU, TENN, TEX, WIS, WVA, US); Northhampton Co., near Jackson, Rhoades Aug. 1935 (F); Onslow Co., 4 miles s. of Verona, Fox & Boyce 3723 (GH, MICH, NCS); Pamlico Co., Olympia, L. F. & Fannie Randolph 906 (GH); Pender Co., Burgaw, Godfrey 4742 (GH, US); Robeson Co., about 17 miles east of Lumberton, Wilbur 2880 (MICH); Richmond Co., 3 miles north of Hoffman, Wiegand & Manning 2551 (GH, CU); Sampson Co., Roseboro, Godfrey 4529 (DUKE, GH, US); Scotland Co., 15 mi. n. of Laurinburg, Godfrey 5049 (DUKE GH, US): Wake Co., Method, Godfrey 4926 (GH, NCS): Wayne Co., near Goldsboro, Schallert 10 July 1935 (DUKE).

SOUTH CAROLINA: Beaufort Co., Bluffton, collector not stated (US); Berkeley Co., about 6 mi. ne. of Summerville, Wilbur & Webster 3854 (MICH); Charleston Co., along Coastal Highway 5.5 miles southwest of Santee River, McVaugh 4554 (GA); Darlington Co., near Society Hill, Smith 1 Aug. 1884 (US); Dorchester., Summerville, Macfarlane & Goertz 24 June 1905 (CU, GA); Georgetown Co., 12 miles north of Georgetown, Godfrey & Tryon 65 (DUKE, F, GH, MO, NY, PENN TENN, US); Hampton Co., 6 miles nw. of Yemassee, Wilbur

& Webster 2838 (MICH); Horry Co., between Conway and Myrtle Beach, Correll 5204 (DUKE); Jasper Co., near Okeetee, Correll 5406 (GH, NA); Marion Co., 3 miles west of Marion, Wiegand & Manning 2566 (CU, GH); Sumter Co., without exact locality, Smith 4 Aug. 1884 (GH, US); Williamsburg Co., 2 miles west of Salters, Godfrey & Tryon 527 (GH, NY, US).

GEORGIA: Bryan Co., near Lanier, McKay 14 Aug. 1940 (GA); Bulloch Co., without exact locality, Harper 886 (MO, NY, US); Camden Co., about 4.3 miles n. or White Oak, McKay 8 June 1931 (GA); Chandler Co., 10 mi. ne. of Metter, Pyron & McVaugh 731 (GA); Charlton Co., below Trader's Hill, Small June 1895 (F, NY): Chatham Co., without exact locality, collector not stated, 6 Aug. 1897; Decatur Co., 3 miles northeast of Faceville, Thorne 4808 (CU, GA); Glynne Co., 8 miles north of Brunswick, Moldenke 5206 (NY); Grady Co., about 8 mi. n. of Whigham, Cronquist 5463 (GA); Lanier Co., 3 miles north of Lakeland, McKellar 9 July 1937 (GA); McIntosh Co., 1.5 mi. n. of Darien, Cronquist 5375 (GA, US); Richmond Co., Augusta, Cuthbert Aug. 1876 (RUT); Thomas Co., about 1 mi. n. of Coolidge, Duncan 8468 (FLAS, GA, MO); Tift Co., about 7 miles n. of Tifton, McKay 3 June 1931 (GA); Ware Co., Hopkins to Waycross, Wright 868 (CU); Wayne Co., 2 miles nw. of Odum, Duncan 9711 (GA); Worth Co., 1.2 miles west of Sylvester, McKellar 24 June 1937 (GA).

FLORIDA: Alachua Co., Gainsville, Murrill 27 June 1937 (DUKE, MO, PENN); Bradford Co., 3 mi. beyond Starke, Murrill 530 (US); Clay Co., 2 miles north of Goldhead Branch State Park, West & Arnold 15 July 1947 (GA); Dade Co., Biscayne Bay, Rusby (MICH); otherwise not known south of Lake Okeechobee; (error in labeling?) DeSoto Co., Lacy, West 23 Sept. 1938 (FLAS); Duval Co., St. Nicholas, Lighthipe 371 (NY, WIS); Escambia Co., Millview, Mohr June 1880 (US); Gadsen Co., southwest of Quincy, Small, Small & DeWinkeler 11390 (GH, US); Highlands Co., along Lake Nancessowee near Sebring, Small, Small & Dewinkeler 17 July 1924 (FLAS, GH, NY, US); Hillsborough Co., Tampa, Garber May 1876 (BRU, F, NY, US, YU); Lake Co., Eustis, Nash 849 (CU, F, GH, MICH, MO, MT, NY, US); Leon Co., near Tallahassee, Berg 1894 (NY); Manatee Co., Bradentown, Tracy 7541 (CU, F, GH, MO, NY, US, WIS); Marion Co., Stanton, Schallert 840 (FLAS); Nassau Co. w. of Callahan, Hood 4418 (FLAS; Okaloosa Co., 4 miles east of Crestview, Webster & Wilbur 3592 (MICH); Orange Co., without exact locality, Curtiss June (CU, F, MO, NY, US, YU); Osceola Co., Tampa highway near county line, Singeltary 29 May 1938 (DUKE, NCS); Polk Co., 16 miles southwest of Kissimmee, Wilbur and Webster 2637 (MICH); Putnam Co., Welaka, DeVall 2 June 1939 (FLAS); St. Johns Co., 10 mi. w. of St. Augustine, West & Arnold 7 June 1940 (FLAS); Santa Rosa Co., across from the town of Milton, Webster & Wilbur 3579 (MICH); Seminole Co., Chuluota O'Neill 20 June 1929

(US); Volusia Co., DeLand Landing, Hood 27 June 1910 (GH, MO); Wakulla Co., St. Marks, Rugel June 1843 (NY); Walton Co., near DeFuniak Springs, Curtiss 5906 (CU, F, FLAS, GH, KSC, NCU, NY, SMU, US); Washington Co., 1 mile e. of Caryville, Webster & Wilbur 3601 (MICH).

The only species with which S. difformis might be confused is S. macrophylla, which belongs to the same subsection and which shares with it the distinctive features of a stout gnarled rhizome bearing numerous thick fleshy roots, characteristically opposite branches, thick leaves and white 5 (6)-parted corolla. However, S. difformis may be readily distinguished from S. macrophylla by numerous striking differences among which are the absence of a glaucous bloom, the almost invariably longer calyx lobes, bractlets, and corolla lobes; the very common change of color to orange or saffron upon drying, the stem angled or quadrate above, and the typically smaller stature. The ranges of the two species overlap in Georgia and in Florida; but throughout the main part of the area occupied, they are not compatriots.

The synonymy of this species is extensive and there has been much confusion throughout the literature regarding these names. It therefore seems advisable to discuss each of them briefly.

1. Swertia difformis L. is based upon the Gronovian "Gentiana foliis linearibus acuminatis, pedunculis, longissimis nudis unifloris oppositis" which in turn rested upon

Clayton's collection 171 and also on two other specimens or perhaps descriptions sent by Clayton. These last two references apparently did not influence Linnaeus' concept and it is very unlikely that they entered heavily into that of Gronovius as they presented characteristics that were in direct contrast to those described in the principal account. They certainly both belonged to at least a different species. The specimen of Clayton's herbarium, which is now in the British Museum, is, as shown by the photograph in the Gray Herbarium or by Blake's sketch of it (Rhodora 17: pl. 112), the uppermost portion of the rhizomatous perennial possessing characteristically opposite branches and a white, 5(6)-parted corolla. The specimen is peculiar in that the six lateral branches are very elongate and bear but one flower each. Hence the inflorescence is very loose. The terminal flower is six-parted and this is shown very clearly in the photograph. The original description little suggests the plant that it is now known to depict and it is therefore not too surprising that its proper disposition was but so recently accepted by most American botanists. The diagnosis is excellent as a description of the somewhat atypical specimen in Gronovius' herbarium, the photograph of which is unmistakably the opposite-branched perennial which was known throughout the latter half of the nineteenth century as S. lanceolata (Walt.) T.& G. Druce, in transferring the epithet difformis, referred it to what has been called S. elliottii, an alternate-branched, white-flowered annual. In this he was following either the "Synoptical Flora" or

the "Index Kewensis." Clayton's specimen, although it has sometimes been referred to that species, has nothing to do with the annual. That alternate-branched annual, furthermore, has not been found north of South Carolina; the opposite-branched perennial is known from southeastern Virginia, where Clayton served as a clerk of the court of Gloucester County for many years.

Card (Ann. Mo. Bot. Gard. 18:262. 1931.) in his monograph of Frasera listed Swertia difformis as a synonym of Frasera caroliniensis Walt. This mistake has been previously and emphatically pointed out by St. John (Am. Midl. Nat. 26:5. 1941.). Card was no doubt following Rafinesque (1828, p.196) who listed this name as a synonym of his substitute name, F. verticillata. Merrill (1949, p,192) also equates Frasera verticillata in part to Sabatia difformis.

2. Chironia lanceolata Walt. Of the seven fragmentary specimens of Sabatia still represented in Walter's collection in the British Museum, two match the brief description of C. lanceolata and are certainly referable to the opposite-branched perennial. As has been reported many times the original labels were lost even before the time of Gray; still there can be little doubt as to what Walter called them in most instances. The association of the epithet lanceolata with the perennial has been almost invariably the rule from at least the time of Pursh (1814) who, as stated in his Preface, had examined Walter's

collection then in the possession of John Fraser's son. The combination of Walter's epithet with Sabatia can perhaps first be credited to Torrey and Gray (in Gray's Manual, 1848), who described the plant and listed S. corymbosa Ell. as a synonym. The only name listed in synonymy under S. corymbosa when it was originally described was Walter's Chironia lanceolata. The synonymy of this species presented by Grisebach in 1839 and also in his treatment in the Prodromus (1845) was complete and these accounts were doubtless the basis for Gray's treatment. It is to be remembered that Gray examined Walter's collection in 1839 while it was still in the possession of Fraser's son.

Rafinesque (1837) may have intended this transfer when he listed "lanceol." in an ennumeration of the genus Sabatia. Many of his names in this list were never described as his promised monograph never appeared. For S. lanceolata (as lanceol.), there was no basic synonym or description, so even listing the name in synonymy may not be warranted.

3. Chironia cymosa Lam. A photograph of the type, which is in Paris, was loaned by the Gray Herbarium and it also proves to be a specimen of S. difformis of the narrowly linear-leaved type with rather long acuminate apices. The specimen as is shown by the label was one of Fraser's from "eastern [South] Carolina."

Rafinesque (1837), in the same list of names in which "lanceol." appears, also included cymosa and again without a synonym or description. It is at least possible

that a transfer was intended.

This epithet, cymosa, was transferred formally by G. Don (1838) with the necessary synonym. The description that accompanies the name, however, applies only to S. quadrangula, a very different species.

4. Chironia paniculata Michx. is more fully discussed under S. quadrangula with which it has been so long confused. The original description was very brief and the few clues presented there have been either overlooked or misunderstood. The plant was known by its author from Georgia and "Carolina." The photograph at the Gray Herbarium of the collection in Michaux's herbarium, labeled "Chironia paniculata Georgia," illustrates an excellent specimen. It is unmistakably what is here called S. difformis. Pursh transferred Michaux's epithet to Sabatia and noted the synonymy with both Swertia difformis and Chironia lanceolata. He had seen the specimen upon which Swertia difformis is based in Bank's herbarium and, as he acknowledged having examined Walter's collection, he was acquainted with authentic material of Walter's species. In addition Pursh designated two varieties; from their descriptions I believe them to represent merely the broad- and narrow-leaved variations that are common among this species. Gray (1878) and subsequently Blake (1915) considered Chironia paniculata β angustifolia, excluding C. lanceolata listed in synonymy by Pursh, to be what is here called S. quadrangula.

5. Chironia venosa Muhl. was relegated to the synonymy of the opposite-branched, white-flowered perennial

by Torrey as early as 1824. Those names published for the first time in Muhlenberg's Catalogue are so briefly characterized that Merrill and Hu (Bartonia no. 25:22. 1949.) stated that they should be considered as nomina nuda unless a basonym were included. The information presented with Chironia venosa was that the corolla was white and veiny and that the plant was a perennial found in "N. Caes. Ten." S. difformis is now known from Tennessee, nor is any other perennial or any other typically white-flowered species. It is found in New Jersey. Except for the reference to Tennessee there can be little doubt that Chironia venosa is the same as S. difformis. The specific names aptly describe the common occurrence of an orange discoloration especially noticeable along veins of the corolla lobes after drying.

6. Sabbatia corymbosa Baldw. ex Ell. is the last of the names proposed for the white-flowered, rhizomatose perennial. Authentic specimens from Elliott's herbarium confirm the identity of this name as a synonym of S. difformis. The herbarium sheet apparently bears two collections, which may be taken as types; one with ovate-leaves apparently representing the typical element and the other with narrower leaves, a representative of his S. corymbosa var. angustifolia. This specific name was generally employed in designating the perennial species until the combination of S. lanceolata was made in 1848.

2. Sabatia macrophylla Hook.

Sabbatia macrophylla Hook., Comp. Bot. Mag. 1: 171. 1836.

Perennial herb (50 90--120 (140) cm. high, 2--7 mm. in diameter, usually with several stems arising in a cluster from a stout gnarled and branched rhizome up to 1 cm. in diameter and often 10 cm. or more in length. Stem stiffly erect, hollow, terete throughout, without ridges or fine lines extending between the nodes, rather strikingly glaucous above. Numerous white to reddish-brown fleshy roots descending in clusters from the rhizome often 15 cm. or more in length and about 2 mm. in diameter with occasional slender, fibrous, lateral roots. Branches typically opposite, very rarely alternate, generally restricted to the upper tenth or quarter, or more rarely throughout the upper half of the stem, ascendent to rather strongly divergent, forming an angle of 15--60 degrees with the stem, and producing a compact corymibose flat-topped to somewhat convex inflorescence. Leaves thick, firm, coriaceous, drying thickly chartaceous, strongly ascendent, very noticeably glaucous when fresh, ovate-lanceolate, lanceolate (sometimes very narrowly so), oblong to ovate-oblong or even ovate, acute or rarely obtuse, hyaline-mucronate tipped, margins conspicuously hyaline and often slightly revolute, strongly clasping, (2.5) 3--6 (8.5) cm. long, (0.5) 1--2.5(4.5) cm. wide, midvein prominently elevated beneath, 1--2 pairs lateral veins also often rather conspicuous. Basal rosette

none; the lowermost cauline leaves absent at time of flowering. Internodes typically 3--5-times the length of the leaves. Inflorescence of numerous cymules corymbosely arranged forming a compact flat-topped to somewhat convex cluster. Leaves within the inflorescence abruptly reduced to acute, scale-like, non-chlorophyllous bracts 1--4 mm. long, the ultimate bracts less than 2 mm. long; the flowering clusters thus appearing naked. Pedicels slender, erect or ascendent, 1--5 mm. long. Calyx more or less colorless, non-chlorophyllous; the tube campanulate, scarcely ridged or lined by elevated vascular traces, 1--2 mm. long; the lobes triangular-dentate, subulate, or linear, erect, slightly spreading, or somewhat outwardly curved at the tip, or strongly recurved, (0.1) 0.2-2.5 (3.0) mm. long, 0.1--3.5 times the length of the calyx tube. Corolla tube narrowly cylindrical, white, (2) 3--3.5 (4) mm. long. Corolla lobes oblong to oblong-spatulate, obtuse, widely spreading at anthesis, (4) 5--7 (8) mm. long, 2--3(4) mm. wide, entirely white or creamy-white, color not changing after drying. Filaments (1.5) 3--4 mm. long, white; anthers slender, lanceolate, creamy-white to pale-yellow, 1--2 mm. long. Capsule globose or nearly so to ovoid, (3) 3.5--4 (4.5) mm. high, (2) 3--4 mm. wide.

KEY TO THE VARIETIES

a.) Calyx lobes erect or only slightly outwardly curved at the tip, equalling or less than the calyx tube in length. . . . . 2a. var. <u>macrophylla</u>

a.) Calyx lobes strongly recurved, exceeding the calyx tube in length . . . . 2b. var. recurvans

2a. Sabatia macrophylla Hook. var macrophylla

Sabbatia macrophylla Hook., Comp. Bot. Mag. 1: 171. 1836.

Calyx lobes (0.1) 0.2--1.5 (2) mm. long, triangular-dentate to linear, erect or only slightly outwardly curved at the tip, equalling or less than the calyx tube in length (very rarely the centermost flower of the central cymules may have a ratio of lobe to tube greater than 1).

Type locality: near Covington, Louisiana. Type: Drummond s.n. (K!).

DISTRIBUTION. Savannas and pine-barrens and margins of low hardwood from western Florida and Georgia westward into Louisiana.

SPECIMENS EXAMINED.

GEORGIA: Muscogee Co., Columbus, Boykin (BRU, GH, NY); Sumter Co., Americus, Harper 30 July 1897 (GH).

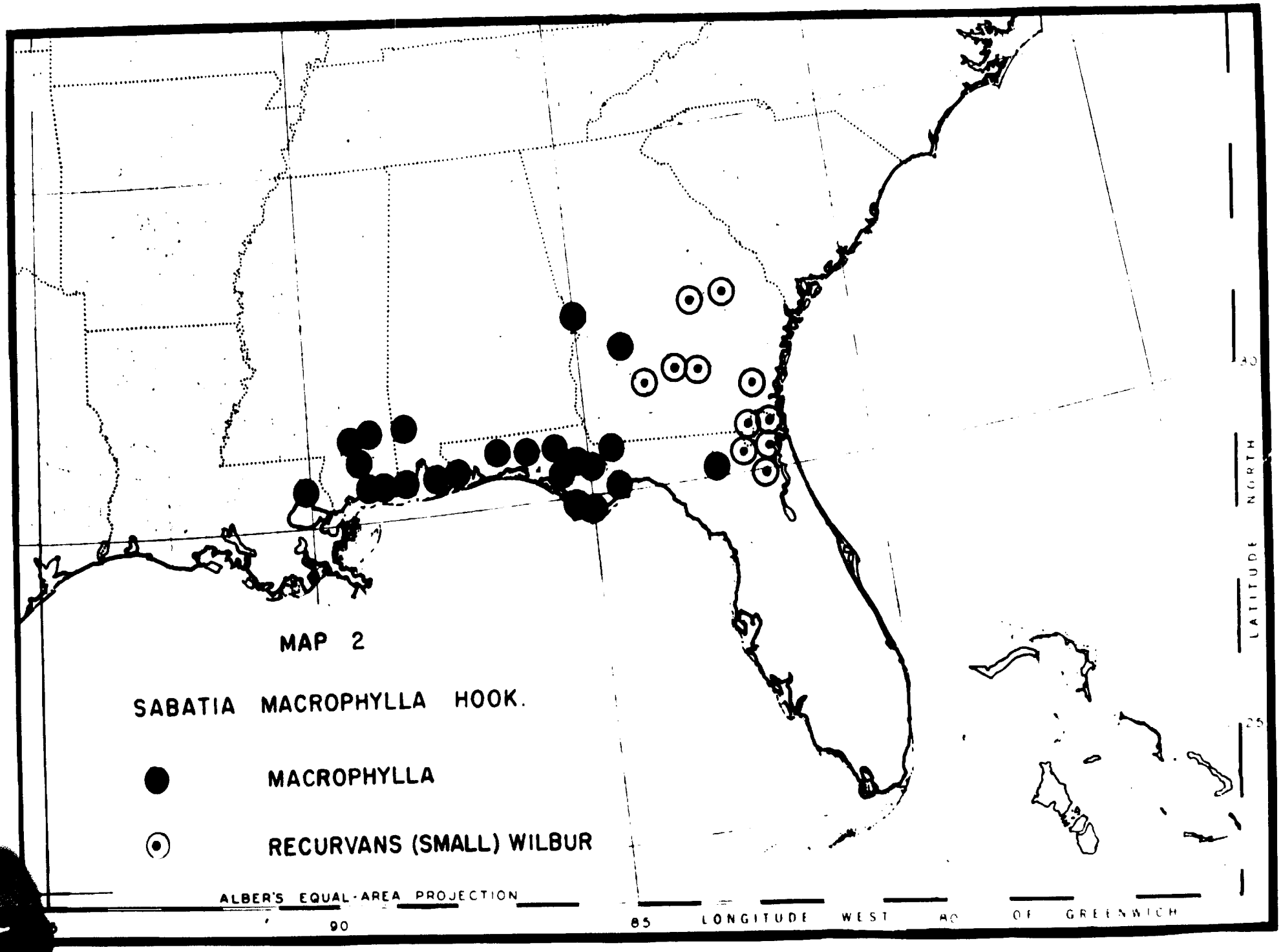
FLORIDA: Bay Co., 1 mile north of Lynn Haven, Webster & Wilbur 3626 (MICH); Calhoun Co., 2 miles south of Chipola, Thorne & Muenscher 8744 (CU); Columbia Co., Lake City, collector not stated (F); Escambia Co., 9 miles west of Pensacola, Webster & Wilbur 3575 (MICH); Franklin Co., Apalachicola, Chapman, Biltmore Herb. Dist. 4508a (GH, NY); Gadsen Co., inter Quincy et Aspalga, Rugel July 1843 (MO, NY); Gulf Co., Port St. Joe, Knight 18 June 1936

MAP 2

Distribution of *Sabatia macrophylla* Hook.

● var. *macrophylla*

⊙ var. *recurvans* (Small) Wilbur


MAP 2
SABATIA MACROPHYLLA HOOK.
MACROPHYLLA
RECURVANS (SMALL) WILBUR
ALBER'S EQUAL-AREA PROJECTION
90
85
LONGITUDE WEST
OF GREENWICH
LATITUDE NORTH
30
25

(FLAS); Liberty Co., Bristol, West & Arnold 23 July 1940 (FLAS); Okaloosa Co., about 3 miles east of Crestview, Webster & Wilbur 3584 (MICH); Wakulla Co., 1.5 miles south of Sopchoppy, Webster & Wilbur 3628 (MICH); Walton Co., near Argyle, Curtiss 5931 (CU, FLAS, GH, KSC, MO, NCU, NY, SMU, US); Washington Co., 8 miles south of Chipley, Webster & Wilbur 3614.(MICH).

ALABAMA: Baldwin Co., 13.5 miles west of Foley, Webster & Wilbur 3530 (MICH); Mobile Co., about 8 miles west of Mobile, Webster & Wilbur 3481 (MICH); Washington Co., 40 miles north of Mobile, Sargent 18 June 1950 (GA, NCS).

MISSISSIPPI: Forest Co., Lake Shelby State Park about 14 miles south of Hattiesburg, Webster & Wilbur 3402 (MICH); Harrison Co., Biloxi, Tracy 7006 (F, MO, NY, US); Jackson Co., Ocean Springs, Pollard 1064 (CU, F, MO, NY, US); Perry Co., 9 miles north of Beaumont, Webster & Wilbur 3422 (MICH); Stone Co., 3 miles south of Wiggins, Webster & Wilbur 3439 (MICH).

LOUISIANA: St. Tammany Parish, Covington, Drummond, TYPE (K!)

2 b. Sabatia macrophylla Hook.
var. recurvans (Small) comb. nov.
Sabbatia recurvans Small, Man. SE. Fl. 1049. 1933.

Calyx lobes (1)1.5--3 mm. long, linear to subulate,

strongly recurved, typically exceeding the calyx tube in length (less than 3 per cent of the nearly 200 lobes measured had a lobe to tube ration of 1 or 1.2).

Lectotype locality: 10 miles east of Dublin, Laurens Co., Georgia. Lectotype: Harper 1415 (NY!)

DISTRIBUTION: Savannas and pine-barrens of southern Georgia and northeastern Florida.

SPECIMENS EXAMINED.

GEORGIA: Brantley Co., 3 miles east of Nahunta, Wilbur & Webster 2748 (MICH); Charlton Co., 8 miles south of Folkston, Wright 881 (CU); Coffee Co., without exact locality, Harper 708 (NY, US); Emanuel Co., east of Swainsboro, Duncan 2677 (MICH); Irwin Co., east of Ocilla, Harper 1415 (F, GH, MO, NY, US); Laurens Co., 10 miles east of Dublin, Pyron & McVaugh 750 (GA, US); Worth Co., 3.5 miles west of Sylvester, Thorne 6363 (CU).

FLORIDA: Baker Co., without exact locality, Curtiss 2224 (CU, F, MO, NY, US, YU); Clay Co., without exact locality, Todsen 30 July 1939 (FLAS); Duval Co., 15 miles west of Jacksonville, Weigand and Manning 2566 (CU, GH); Nassau Co., without exact locality, Knight 1 July 1941 (FLAS).

Small (1933) proposed as a segregate from S. macrophylla Hook. an entity which he named S. recurvans. The several distinguishing features mentioned by him are presented below in tabular form.

S. macrophylla Hook.	*S. recurvans* Small
1. Calyx 2--3 mm. long, lobes shorter than the tube.	1. Calyx 4--5 mm. long, lobes longer than the tube.
2. Corolla lobes 6--8 mm. long.	2. Corolla lobes 5--6.5 mm. long.
3. Capsule 3--4 mm. long.	3. Capsule 3.5--4.5 mm. long.
4. Style and stigma about equal in length.	4. Style much shorter than the stigma.

Five specimens in the Herbarium of the New York Botanical Garden at that time belonged to the *recurvans* population; two of these were *Harper* 1415 and 708, both apparently annotated by Small. Specimens of Harper's 1415 are represented in several herbaria; these are excellent examples of the group. The specimen at New York is, therefore, chosen as the lectotype. It lacks fruit which was apparently described from Harper's 708.

The specimens of *S. recurvans* available to Small at New York were too few for evaluation of the supposedly distinguishing features. This is especially true in regard to the overlapping size ranges of both corolla lobes and capsules published as supplementary evidence of the existence of two distinct entities. These overlapping ranges might be of some significance if based upon a large series of specimens but in this instance they furnished only "padding" to an otherwise scantily characterized group. Even now few fruiting specimens are available and measurements indicate a range of 3--4.5 mm. in length of capsule

in both species. The length of the corolla lobes is equally useless as a distinguishing feature, as the range of S. macrophylla was between 4--8 mm. and that of S. recurvans between 4--7 mm. The slight discrepancy would very likely disappear if a larger series of measurements were made. The variation in the length of the corolla lobe is apparently strongly affected by environmental conditions and the season in which the flowers are produced. Flowers developing later in the season are generally much smaller than those appearing earlier in the year. Therefore the characters with overlapping ranges presented by Small as supporting evidence of the distinctness of the two entities break down completely with the examination of a larger series of specimens.

The ratio of the style length to that of the stigmas was indicated by Small to be a reliable distinguishing feature. It was even used by him as a secondary key character. The comparative length of these structures varies enough so that one may find either the stigma or the style longer on the same plant; consequently this criterion is useless as a means of distinguishing these supposed entities. Also the comparative length of the stigma to the style varies considerably in different stages of maturity.

The calyx, however, does have characteristics which at present seem to be distinctive. Specimens can be assigned to one group or the other by those features and the two groups thus defined occupy, as far as is now known, adjacent but distinct areas. Small's very convenient gap

of 1 mm. between the size ranges of the calyx in the two disappears with the examination of a number of flowers. The overall calyx length of macrophylla is 1.1--3(4) mm., whereas that of recurvans is (2)2.5--4.0(4.5) mm. long. The overlap of these ranges is too great to be of aid in identification.

A comparison of calyx lobe length has much more promise, but that too fails to provide a clear-cut distinction that might be rigidly applied. The macrophylla population has lobes (0.1)1--1.5(2) mm. long. Of the more than six hundred lobes measured in this group nearly sixty per cent were less than 1 mm. long, and over ninety-six per cent of the lobes were less than 1.2 mm. long. The very small percentage of flowers with calyx lobes longer than 1.2 mm. may be attributed to the centermost flower of the inflorescence or to the oldest flower of the cymules closest to the center of the compound inflorescence. These flowers are often strikingly different from the others on the same plant. Calyx lobes of S. macrophylla var. recurvans measured (1)1.5--3 mm. long with only five flowers (less than three per cent of the total) with lobes less than 1.5 mm. long, while more than seventy per cent of the nearly two hundred lobes were 2 mm. long or longer.

The ratio of lobe length to tube length provides a somewhat sharper means of separation but even here there is no clear-cut gap between the two populations. The range of this ratio in the macrophylla group is (0.1)0.2--1(2) with

all but five flowers of those measured with lobes equalling or less than the tube in length. These few flowers were again the centermost which are often strikingly different from the others in the inflorescence. The same ratio range in the recurvans population is (1)1.3--3(3.5) with only four flowers (2.3 per cent) equalling the tube and nearly forty per cent of the flowers possessing lobes two or more times longer than the tube.

Even the recurved feature of the lobes is not absolutely restricted to the recurvans group as some of the longer lobed specimens of macrophylla, which are found in the extreme eastern portion of its range, show an indication of this tendency by possessing lobes slightly recurved at the extreme tip.

The most usable of the criteria now known to me for the separation of the macrophylla from the recurvans population is the length of the calyx lobes. Yet it seems very likely that the group known as S. macrophylla var. macrophylla possesses pronounced clinal variation from west to east and that this variation is in the direction of the even more easterly population known as S. macrophylla var. recurvans. The calycine lobes of the plants from the vicinity of Apalachicola, Florida, seem on the average longer than those from the Covington area of Louisiana. Sabatia difformis, the species most closely related to the complex discussed above, is usually readily distinguished by calyx lobes which are almost invariably longer than even those of recurvans. Again there is no clear

break between the two populations. The range of calyx lobe length in *recurvans* overlaps but slightly that of *S. difformis.* In the latter only a few calyx lobes were less than 4 mm. long.

One may find among flowers of a specimen from one population calyx lobes that fit more closely those characteristic of another group. Those aberrant flowers are always very few, if not entirely lacking. The material at hand may be readily assigned to one population or the other with little more than a glance at several calyces and the two groups have, as far as is now known, separate ranges. The two entities which I now consider to represent weakly differentiated geographical varieties, are not distinguished by strong, or even exclusively delimiting morphological characters. Nor are the two varieties strongly segregated geographically as they are already known to occur at least within fifty miles of one another. It is puzzling to find even as weakly distinguishable entities as these with apparently so slight a barrier isolating them.

B. Subsection ANGULARES Blake

Subsection *Angulares* Blake, Rhodora 17:56. 1915.

Annual with fibrous roots and with typically opposite branches. Leaves thin and membranous, margins not thickened. Basal rosette usually well-developed at some time during maturation of plant.

TYPE SPECIES: *Sabatia angularis* (L.) Pursh

The three species comprising subsection *Angulares*,

as here restricted, are readily distinguished from one another by strong and constant morphological characters. As a group they are strongly differentiated from all other subsections of section Eusabatia. The annual habit separates them from subsections Difformes and Dodecandrae; the opposite branches and the typically 3-flowered cymules set them apart from the Campanulatae; and the thin, merely finely ridged calyx tube and the opposite branches easily distinguish the Angulares from the Campestres. This subsection occupies the largest area of any within the genus. Representatives are found as far west as the eastern parts of Texas, Oklahoma, and Kansas with the northern boundary apparently located in Missouri, Illinois, southern Michigan, Ohio, New York and New Jersey. One species, S. angularis, is found throughout almost the entire range of the subsection while the other two species have somewhat more restricted areas of distribution being more southernly or easternly.

KEY TO THE SPECIES

A. Lower portion of the stem strongly 4-angled, quadrate, the corners with conspicuous membranously-winged margins.

B. Corolla pink to roseate (very rarely white); pedicels elongate, 1 cm. or more in length; lower cauline leaves usually broadly ovate to ovate-lanceolate, usually less than 3 times as long as broad; calyx lobes

usually 1.5 mm. or more in width (rarely as narrow as 1 mm.). . . . . 3.) S. angularis

B. Corolla white; pedicels short, less than 5 mm. long; lower cauline leaves usually oblong to linear, generally 4 or more times as long as broad; calyx-lobes usually less than 0.5 mm wide....4.) S. quadrangula

A. Lower portion of the stem terete and not bearing thin membranous wings. . . . . 5.) S. brachiata

3. Sabatia angularis (L.) Pursh

Chironia angularis L., Sp. Pl. 1: 190. 1753.

Chironia angularis var. latifolia Michx., Fl. Bor.-Am. 1: 147. 1803.

Sabbatia angularis (L.) Pursh, Fl. Am. Sept. 1: 137. 1814.

Sabbatia angularis var. albiflora Raf., Med. Fl. 2: 77. 1830. nom. nud.

Sabbatia angularis var. elatior Raf., l.c. nom. nud.

Sabbatia angularis var. latifolia Raf., l.c. nom. nud.

Sabbatia angularis var. pauciflora Raf., l.c. nom. nud.

Sabbatia angularis f. albiflora (Raf.) House, Bull. N. Y. State Mus. 254: 566. 1924.

Sabbatia angularis f. cleistantha Fern. Rhodora 42: 474. 1940.

Erect annual (15)30--50(90) cm. tall, often robust and usually with the numerous branches presenting in plants developed under favorable conditions a bushily compact

aspect. Stem strongly tetragonal, hollow, the corners conspicuously wing-angled by thin membraneous extension 0.1 --0.5 mm. wide. Stem green in younger portion becoming yellowish straw-colored below, (1.0)2.0--3.0(5.0) mm. in diameter. Branches typically opposite although the ultimate often alternate, usually by marked abortion of opposing bud, or generally alternate in depauperate plants, often numerous, rarely extending to base, but more typically restricted to upper third or half of stem, rather closely ascendent forming angle of about 20--45 degrees with main stem, composed of 1--10 nodes in well-developed plants and forming a convexly-corymbose or pyramidal compact crown. Roots several, fibrous, 4--10(20) cm. long, (0.2) 1.0--3.0 (4.0) mm. in diameter, wide-spreading and usually shallowly situated. Leaves thin membranous, spreading to ascendent, drying thin, 5--7-nerved or fewer in those leaves transitional to bracts, (1) 2--3.5 (4.5) cm. long, (0.8) 1--2.5 (3.5) cm. wide, venation prominently elevated beneath. Basal rosette rarely present at anthesis, composed of spreading shortly-spatulate, broadly oblong to obovate, obtuse leaves up to about 4 cm. long and often 2--3 cm. wide. Lowermost cauline leaves usually absent at time of flowering, the lowest usually broadly ovate, always strongly clasping, obtuse, typically nearly as broad as long, the middle narrower, more typically ovate-lanceolate, obtuse or more commonly acute, and gradually reduced and modified above to the 1-nerved linear bracts. Internodes generally

about 1.5--3 times as long as the leaves. Inflorescence of corymbosely- or pyramidally-arranged cymules, either or both of the lateral branches may be suppressed. Pedicel 5-sided, slightly wing-angled, (1.0)2--3.5(4.5) cm. long, erect or strongly ascendent. Calyx tube thin, shallow, 2--5 times exceeded by the corolla tube, usually about 1.5 mm. long (1--2 mm.), with venation somewhat elevated. Calyx lobes thin, narrowly linear, linear-oblong, to foliaceous, usually about 1 cm. long (0.4--1.5 cm.) and (1)1.5--2.5(3.5) mm. wide, ascendent in bud, wide-spreading at anthesis, usually exceeded by the corolla by 5--12 mm. Corolla tube 4--7 mm. long, 2--4 mm. in diameter, cylindrical, pale greenish-white within and without. Corolla lobes oblong, spatulate, or elliptic, obtuse, wide-spreading, (0.6)1--1.8(2.2) cm. long, (2)4--7(9) mm. wide, greenish in bud turning white prior to full development and typically pink or rose at anthesis or rarely white, coloration paler beneath, with an irregular, somewhat pointed yellow or greenish-yellow area at base of lobe usually bordered by a dark-red line. Filaments 2.5--4.5 mm. long, greenish-yellow to pale-yellow; anthers slender, bright-yellow, 3--5 mm. long. Stigmatic lobes very slender, 3--6 mm. long. Style 4--6 mm. long, usually somewhat less than length of stigmatic branches. Capsule cylindrical at maturity, 5--9 mm. high, 4--6 mm. wide.

Type locality: "In Virginia." Type: Kalm (in the Linnean Herbarium), but not seen.

DISTRIBUTION: Margin of woods, fields, and prairies

from New York south to northern Florida and west to Illinois and Texas.

SPECIMENS EXAMINED.

CONNECTICUT: Locality not stated, Wright (YU).

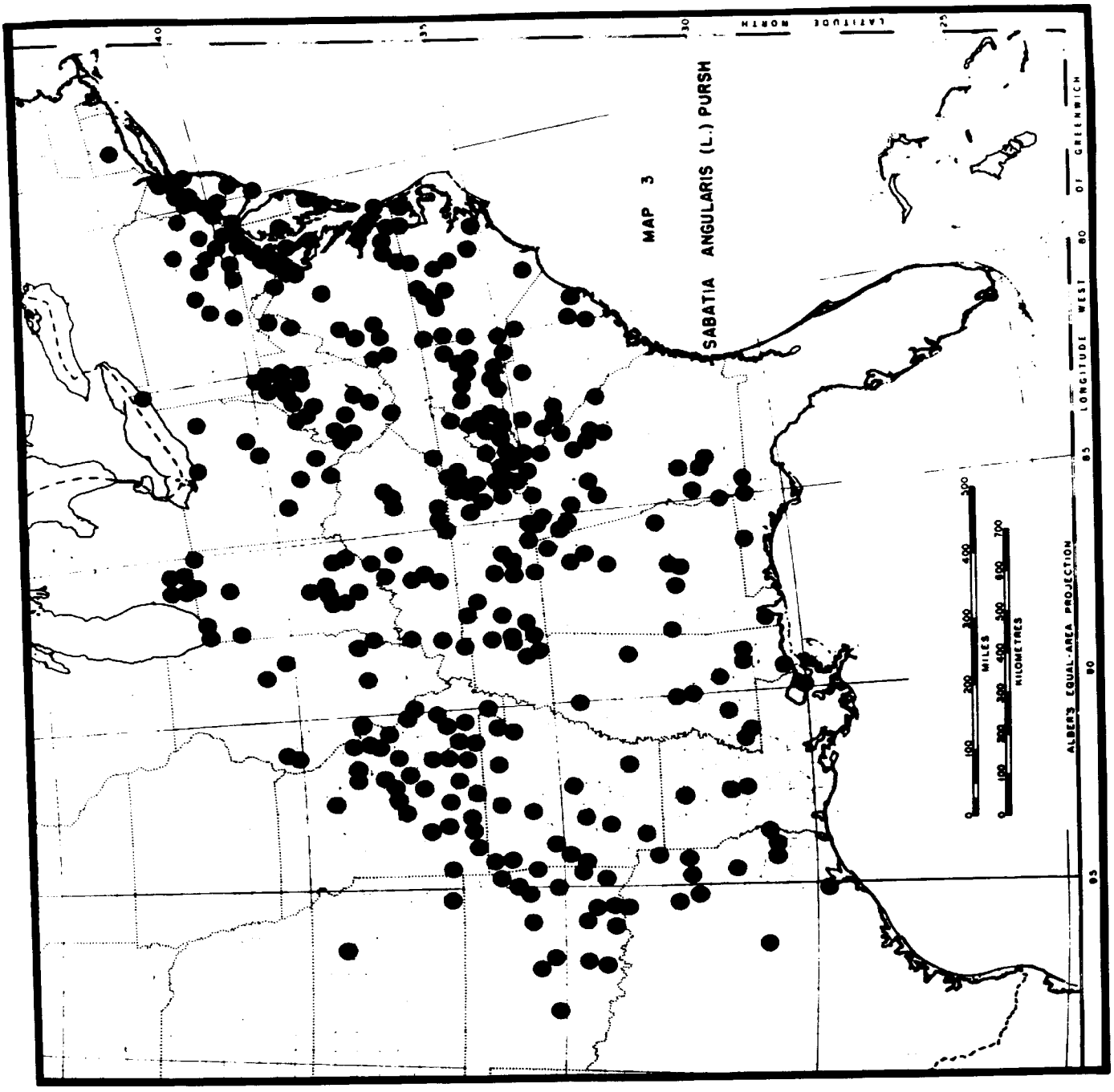
NEW YORK: Richmond Co., near New Dorp, Britton 9 Aug. 1879 (YU).

NEW JERSEY: Atlantic Co., Port Republic, Long 10436 GH); Bergen Co., Rutherford, Stone July 1932 (PENN); Camden Co., 2 mi. south of Clementon, Hynes 1430 (PENN); Cape May Co., Cold Spring, Pennell 2128 (US); Essex Co., Belleville, Rusby Aug. 1875 (MICH); Hunterdon Co., Ringoes, Fisher 7 Aug. 1903 (MO, WIS); Mercer Co., Princeton, Schott Aug. 5 (F); Middlesex Co., Monmouth Junction, collector not stated, 4 July 1892 (RUT); Monmouth Co., Locust, Washington 18 Sept. 1899 (NY); Somerset Co., Watchung, Moldenke 6173 (NY); Union Co., Summit, Legget 23 Sept. 1865 (RUT).

PENNSYLVANIA: Adams Co., 1.75 miles south of Hunterstown, Tanger 3451 (PENN); Bedford Co., 0.25 mi. west of Breezewood, Berkheimer 4091 (PENN); Berks Co., 0.5 mi. wnw. of Gibralter, Berkheimer 2926 (GH, PENN); Bucks Co., Yardley, Dreisbach 3742 (MICH); Chester Co., Nottingham Barrens, Pennell 1420 (US); Columbia Co., near Berwick, Heller 4 Aug. 1889 (F, US); Dauphin Co., Powell Valley, Moldenke 20496 (MT, NCS, NY); Delaware Co., 1.5 mi. ene. of Newton Square, Travis 801 (PENN); Erie Co.,

MAP 3

Distribution of *Sabatia angularis* (L.) Pursh


MAP 3
SABATIA ANGULARIS (L.) PURSH
LATITUDE NORTH
LONGITUDE WEST OF GREENWICH
ALBER'S EQUAL-AREA PROJECTION
MILES
KILOMETRES

Presque Isle, Gress 17 Aug. 1919 (PENN); Greene Co., 1.5 miles n. of Waynesburg, Lohr 288 (PENN); Huntingdon Co., base of Tussey Mts., True 2219 (PENN); Lancaster Co., vicinity of the mouth of the Tucquan, Small 7 Aug. 1890 (F, GH); Lebanon Co., Mt. Gretna, Ulrich Aug. 1908 (PENN); Mifflin Co., without exact locality, Rothrock (F); Montgomery Co., 2.75 miles ene. of Glasgow, Berkheimer 6675 (PENN); Northampton Co., 2 miles se. of center square of Easton, Schaeffer 24966 (PENN); Philadelphia Co., Pennypack Park, Berk 166a (PENN); York Co., 1.5 mi. nne. of Winterstown, Wahl 3494 (GH).

DELAWARE: New Castle Co., near Wilmington, Canby Aug. 1878 (MO).

MARYLAND: Anne Arundel Co., Bay Ridge, Brinton 2 Aug. 1891 (PENN); Baltimore Co., near Baltimore, Steitz (US); Calvert Co., near North Beach, Muenscher 3823 (CU); Cecil Co., east of Rocksprings, Long 28474 (GH); Harford Co, se. of Flintville, Adams & Hopkins 923 (CU, PENN); Howard Co., Ellicott City, Arsene 708 (MO); Montgomery Co., Chevy Chase, Smith 4867 (US); Prince Georges Co., Laurel, Knowlton 25 July 1897 (GH); St. Marys Co., Piney Point, Vasey 1874 (KSC); Talbot Co., 3.75 mi. nw. Easton, Earle 1765 (PENN); Worchester Co., Stockton, Rusby Aug. 1889 (NY).

DISTRICT OF COLUMBIA: Chain Bridge, Erlanson & Martin 1210 (NA).

VIRGINIA: Accomack Co., Talsey, Holmes 25 July 1890 (US); Augusta Co., old Greenville Road, Rawlinson 278 (PENN); Bedford Co., without exact locality, Curtiss 4955 (MO, NY); Campbell Co., Lynchburg, Murrill 1 Aug. 1925 (FLAS); Craig Co., just e. of Newcastle, Fogg 13263 (PENN); Elizabeth City Co., about Hampton, Churchill 22 July 1927 (MO); Fairfax Co., 1.75 miles east of Great Falls, Hermann 9594 (F, NA, NY); Fauquier Co., western slope of Bull Run Mountains, Allard 12037 (MT, US); Greensville Co., 4 miles southeast of Emporia, Fernald & Long 8814 (GH); James City Co., 5 miles west of Toano, Manzel 114 (GH); Lee Co., without exact locality, Chance 20 Aug. 1934 (OKL); Loudoun Co., near Broad Run, Hunnewell 10719 (GH); Nansemond Co., Lake Prince Reservoir, Fernald and Long 7572 (GH, NY); Norfolk Co., near Northwest, Kearney 1512 (US); Orange Co., Orange, Baxter Aug. 1925 (WIS); Princess Anne Co., Virginia Beach, Fernald & Long 4132 (GH, PENN); Prince William Co., near Triangle, Baird 238 (US); Roanoke Co., ca 1.2 mi. north of Salem P.O., Wood 6550 (GH); Rockbridge Co., about Lexington, Churchill 17 Aug. 1924 (GH, MO); Southampton Co., southeast of Ivor, Fernald & Long 10784 (GH, MO); Sussex Co., north of Moore's Mill, Fernald & Long 6347 (GH, PENN); York Co., north of Williamsburg, Grimes 4075 (NY).

NORTH CAROLINA: Alexander Co., 10 miles north of Taylorsville, Keever 84 (DUKE); Anson Co., across the Yadkin River, Fox 608 (NCS); Buncombe Co., near Biltmore, Biltmore Herb. 3303a (F, GH, MO, NY, US); Camden Co.,

Camden, Godfrey 5316 (GH, US); Caswell Co., Yanceyville, Godfrey 5552 (GH); Catawba Co., near Sherrill's Ford, Correll 2828 (DUKE); Cherokee Co. 2 mi. n. of Andrews, Fox 4043 (MICH, NCS); Cleveland Co., southwest slope of King's Mt., Correll 2967 (DUKE); Columbus Co., near Freeman, Heller 14107 (MO); Craven Co., near New Bern, Abbe & Spaltholz 29 July 1927 (CU); Davie Co., along the Yadkin River, Correll 2746 (DUKE); Durham Co., about 4 miles northeast of Durham, Wilbur 2898 (MICH); Forsyth Co., Winston Salem, Schallert 1 Aug. 1921 (GH); Gaston Co., Mt. Holly, Mims 15 July 1898 (F); Gates Co., at Gatesville, Godfrey 5249 (GH, US); Graham Co., between Robinsville and the Joyce Kilmer Memorial Forest, Wilbur 1352 (DUKE, NCS); Granville Co., Oxford, Godfrey 5480 (GH); Guilford Co., Greensboro, Schallert 1108 (DUKE); Halifax Co., Roanoke Rapids, Godfrey 5178 (DUKE, GH, US); Haywood Co., Great Smoky Mountains National Park, Barksdale & Jennison 1203 (TENN); Henderson Co., Flat Rock, Memminger 20 July 1885 (NCU); Iredell Co., Statesville, Hyams July 1879 (NY); Jackson Co., Cullowhee, Thaxter 1887 (GH, US); Lenoir Co., 5 miles southeast of Kinston, L. F. & Fannie Randolph 794 (GH); McDowell Co., 3 miles west of Old Ford, Wiegand & Manning 2541 (CU, GH); Macon Co., Franklin, Blomquist 4617 (DUKE); Mecklenburg Co., Charlotte, Correll 3049 (DUKE); Nash Co., between Bailey and Middlesex, Oosting 35570 (DUKE, WVA); Orange Co., Piney Mt., Duke Forest, Oosting 33246 (DUKE); Polk Co., near Columbus, Townsend 262 (CU, US); Randolph Co., near Farmer, Hood 2416 (FLAS); Rockingham Co., Spray, DeChalmot

(US); Rowan Co., Salisbury, Heller 129 (F, MO, NY, PENN); Rutherford Co., upper end of Lake Lure, Oosting 34720 (DUKE); Swain Co., 1.5 mi. s. of Lauada, Fox 4051 (NCS); Transylvania Co., in the Pink Beds, Correll 3367 (DUKE); Union Co., 1.5 miles sw. of Sturtevant, Fox & Whitford 3883 (MICH, NCS); Wake Co., Lake Raleigh, Brimley 15 July 1922 (NCS); Wilson Co., Saratoga, Godfrey 5453 (DUKE, GH); Yancey Co., Mt. Mitchell, Kraus 19 Aug. 1925 (WIS).

SOUTH CAROLINA: Abbeville Co., Abbeville District, collector not stated (GH); Anderson Co., Brown's Park, Davis 2074 (MO, US); Berkeley Co., Goose Creek, Wiegand & Manning 2540 (CU); Chester Co., Chester, Mackintosh 16 Aug. 1935 (GH); Chesterfield Co., Cheraw, Webber Sept. 1921 (CNC); Georgetown Co., without exact locality, Tarbox 610 (NA); Greenville Co., swamps of Reedy River, Smith 21 July 1881 (GH, US); Greenwood Co., Greenwood, Biltmore Herb. 3303d (US); Williamsburg Co., 2 miles northeast of Lane, Godfrey & Tryon 399 (DUKE, F, GH, MO, NY, PENN, TENN).

GEORGIA; Bartow Co., about 4.5 miles south of Allatoona Dam, Duncan 8522 (FLAS, GA, GH, MO, TENN, US); Catoosa Co., 10 mi. w. of Ringgold, Cronquist 5610 (GH, GH, US); Chattooga Co., Summerville, Pollard & Maxon 434 (US); Clarke Co., Athens, Holder 5 July 1929 (GA); Decatur Co., 1 mile north of Chattahoochee, Fla., Thorne 5274 (CU, F, GA, MT, US); DeKalb Co., Stone Mountain, Small 27 July 1893 (MO); Dougherty Co., Albany, Small July 1895 (F, NY); Early Co., 2 miles nw. of Hilton, Duncan 6800 (GA); Elbert

Co., 12.5 miles s. of Elberton, Duncan 11432 (GA); Fannin Co., Blue Ridge Mts., Smith 2534 (F, WIS); Floyd Co., Rome, collector not stated (MO, US); Fulton Co., near Atlanta, Darby 297 (NA); Greene Co., about 15 miles north of Greensboro, Duncan 11338 (MICH); Hancock Co., 5 miles s. of White Plains, Duncan 6491 (MICH); Rabun Co., in ne. corner of county, Duncan 10065 (MICH); Randolph Co., 8 miles north of Cuthbert, Thorne & Muenscher 8135 (CU); Richmond Co., Augusta, Cuthbert 20 July 1909 (FLAS); Stephens Co., nnw. side of Currahee Mountain, Duncan 11759 (MICH); Sumter Co., Leslie, Harper 1124 (MO, NY, US); Taliaferro Co., 4.5 mi. n. of Sharon, Duncan 11386 (GA); Towns Co., s. side of Hightower Bald, Duncan 6900 (GA); Whitfield Co., base of Dick's Ridge, Wilson 141 (NY, US); Worth Co., near southeast corner of Dougherty Co., Thorne 5765 (CU).

FLORIDA: Jackson Co., Sneads, Knight 29 June 1943 (FLAS); Walton Co., northwestern part of county, Hume 27 June 1938 (FLAS).

MICHIGAN: Cass Co., collector and exact locality unknown, 1838 (MICH); Kalamazoo Co., without exact locality, Hermann 9042 (MICH); St. Joseph Co., collector and exact locality unknown, (MICH); Van Buren Co., without exact locality, Nieuwland 14 August 1915 (MT).

OHIO: Coshocton Co., near Coshocton, Moldenke 13289 (OKLA, PENN, SMU); Erie Co., e. of Milan, Mosely 5 Aug.

1897 (F, GH, US); Greene Co., Yellow Springs, Weatherby July 1877 (BRU); Jackson Co., Liberty Township, Bartley & Pontius 32 (NY); Licking Co., Toboso, Jones (DENN); Portage Co., Brady Lake, Hopkins 1284 (GH, MT); Ross Co., Huntington Township, Safford 11 Aug. 1885 (US); Scioto Co., Shawnee State Forest, Demaree 10801 (GH, MO).

INDIANA: Brown Co., Edge of Yellowwood Lake, Springer 23 July 1945 (FLAS, GA, TEX); Elkhart Co., n. of Elkhart, Kauffman 231 (MICH); Fulton Co., 0.4 miles northwest of Disco, Friesner 12571 (DUKE, WVA); Greene Co., 4 miles s. of Hendricksville, Friesner 22345 (FLAS, OKL); Jefferson Co., Hanover, Coulter 1378 (GH); Jennings Co., without exact locality, Hendricks 13 Aug. 1941 (NCU); Lake Co., Millers, Steyermark 65284 (F); Martin Co., 2 mi. south of Owensburg, Deam 41807 (MT); Monroe Co., Bloomington, Evermann Aug. 1888 (US); Morgan Co., about 2 miles west of Centerton, Friesner 17008 (GH, NY, OKLA); Newton Co., without exact locality, Shipman 27 July 1876 (F); Orange Co., about 3 mi. southeast of Paoli, Deam 63425 (SMU); Porter Co., Dune Park, Umbach 18 July 1898 (MICH, TENN); Steuben Co., near Lake Gage, Deam 11 Aug. 1903 (GH, US, WIS, YU).

ILLINOIS: Adams Co., Camp Point. Seymour 30 July 1878 (DUKE); Champaign Co., Mahomet, Waite 21 July 1884 (DUKE); Hancock Co., Augusta, Mead 1845 (F, NY); McLean Co., Lexington, French 15 Aug. 1872 (F); Marian Co., Salem, Bebb 1845 (F, GH, YU); Richland Co., without exact locality

Ridgway 2200 (MO); Wabash Co., Mt. Carmel, Craig 1860 (CU).

WEST VIRGINIA: Cabell Co., overlooking Roland Park, Gilbert 778 (DUKE, F, GA, GH, MICH, MO, MT, NA, NY, OKL, PENN, RUT, TENN, US, WIS); Calhoun Co., without exact locality, Harris 29 July 1933 (WVA); Doddridge Co., near West Union, Allison 3 Aug. 1944 (WVA); Fayette Co., Nuttall, Millspaugh 1117 (WVA); Hampshire Co., Slanesville, Davis 3114 (WVA); Hardy Co., Lost River, W. Va. U. Bot. Exped. 17 Aug. 1928 (WVA); Harrison Co., Lumberport, Sharps 7 Aug. 1939 (WVA); Kanawha Co., up 8 Mi. Creek, Millspaugh 628 (NY, WVA); Lewis Co., Jackson's Mill, Margolin 137 (WVA); Lincoln Co., 2 miles north of Myra, Richmond 113 (WVA); McDowell Co., above Perrysville, Morris 1160 (US); Monongalia Co., Greer, Sharp 9 Aug. 1939 (GH, OKLA); Putnam Co., near Hurricane, Gilbert et al. So. App. Bot. Club Dist. 146 (FLAS, MO, NCS, NY, OKL, PENN, TAES, TENN, WVA); Raleigh Co., 9 mi. e. of Beckley, Tosh 668 (PENN); Ritchie Co., Berea, L. F. & Fannie Randolph 1396 (CU); Taylor Co., Sandy Creek, Blaney 29 July 1929 (WVA); Upshur Co., near Buckhannon, Pollock 13 Aug. 1894 (CU, KSC, MO, US); Wetzel Co., north of Littleton, Haught 665 (WVA); Wirt Co., about 1 mile e. of Elizabeth, Bartholomew 9 June 1933 (WVA); Wood Co., Lockhart's Run, Millspaugh 658 (WVA).

KENTUCKY: Calloway Co., southeast of Aurora, Smith and Hodgdon 4050 (GH, NY, US); Clinton Co., south of Albany, Smith & Hodgdon 3998 (GH, US); Edmonson Co.,

southeast of Mammoth, Svenson 165 (GH); Estill Co., near Irvine, Anderson 31 July 1928 (GH); Grayson Co., without exact locality, Rose 21 Aug. 1895 (US); Jefferson Co., Louisville, Mueller 1886 (YU); Lyon Co., near Eddyville, Clanton 35 (NA); Madison Co., Berea, collector not stated, July 1899 (GH); McCreary Co., Cumberland Falls, McFarland & James 2nd Cent. Fl. Kent 35 (DUKE, GA, MO, NY, PENN, TENN, WIS, WVA, US); Meade Co., near Brandenburg, Anderson 9 Aug. 1928 (GH); Nelson Co., 3 miles se. of Balltown, Wharton 4942 (TENN); Powell Co., 0.5 mile south of West Bend, Wharton 5700 (TENN); Union Co., without exact locality, Shacklette 74 (MT); Warren Co., Bowling Green, Price 4 July 1890 (MO); Wayne Co., south of Monticello, Smith & Hodgdon 3961 (GH, NY, US).

TENNESSEE: Anderson Co., near Norris, Sharp 2760 (GA, TENN); Bedford Co., 2 miles se. of Shelbyville, Sharp, Clebsch & Clebsch 3695 (MICH, TENN); Benton Co., without exact locality, Walker 16044 (MICH, TENN); Blount Co., Cades Cove, Sharps 147 (TENN); Campbell Co., along Powell River, Kelly 2449 (TENN); Carter Co., Hampton, Ruth 10 Aug. 1891 (TENN); Hamilton Co., Chattanooga, Bates 11 July 1888 (MICH); Cheatham Co., Pegram, Svenson 10338 (GH, TENN); Chester Co., Henderson, Bain 157 (NY); Claiborne Co., between Big Barren and Little Barren Creeks, Kelly 2343 (TENN); Coffee Co., e. of Hickerson, Fairchild, Clebsch & Sharp 9881 (MICH, TENN); Decatur Co., without exact locality, Ames 1 July 1855 (MICH); Grainger Co.,

4 miles south of Rutledge, Morrison 30 July 1936 (TENN); Hardin Co., e. of Savannah, Sharp, Fairchild, Clebsch & Clebsch 9484 (MICH, TENN); Henderson Co., sw. of Chesterfield, Sharp, Fairchild, Clebsch & Clebsch 9285 (MICH, TENN); Hickman Co., Beaver Dam Springs, Sharp, Clebsch & Clebsch 47-304 (TENN); Knox Co., Knoxville, Anderson 17 July 1929 (GH, MO); Lincoln Co., near Elora, Biltmore Herb. 3303b (US); McNairy Co., 4.6 miles north of Bethel Springs, Hubricht B1640 (MO); Marion Co., below Hales Bar Dam, Fairchild, Clebsch & Sharp 48-72 (TENN); Monroe Co., Madisonville, Lamson-Scribner Aug. 1890 (US); Montgomery Co., along Palmyra Road, Oliver 90 (TENN): Morgan Co., Rugby, Percival July 15 (F); Roane Co., Rockwood, James 29 July 1883 (US); Rutherford Co., in cedar glades, Svenson 205 (GH); Union Co., Walker's Ford Refuge, Kalter 11 Aug. 1936 (TENN); Warren Co., 1 mile ne. of Morrison, Shanks, Clebsch & Sharp 2849 (MICH, TENN); Wayne Co., se. of Waynesboro, Sharp, Clebsch & Clebsch 6904 (TENN).

ALABAMA: Autauga Co., Prattville, Smith 7 Aug. 1873 (US); Dallas Co., 9 mi. w. of Selma, Webster & Wilbur 3504 (MICH); Etowah Co., Attala, Vasey 5 July 1878 (NY); Jackson Co., Sand Mt., Graves 527 (MO, MT); Lee Co., Auburn, Earle & Baker 8 August 1897 (KSC, NY); Lowndes Co., 23 miles southeast of Selma, Webster & Wilbur 3511 (MICH); Marshall Co., near Albertville, Biltmore Herb. 3303c (US); Mobile Co., Mobile, Mohr June 1878 (US); St. Clair Co., Eden, Barnhart 23 July 1890 (NY); Sumter

Co., Livingston, Rhoades May 1927 (NY).

MISSISSIPPI: Amite Co., 5 mi. southwest of Gloster, Webster & Wilbur 3277 (MICH); Covington Co., 1.5 mi. southeast of Mt. Olive, Webster & Wilbur 3325 (MICH); Forest Co., 18 miles southeast of Hattiesburg, Webster & Wilbur 3434 (MICH); Hancock Co., near Bay St. Louis, Le Clair s.n. (NCU, NY); Lincoln Co., about 10 miles east of Brookhaven, Webster & Wilbur 3297 (MICH); Madison Co., Natchez Trace Parkway, McDougall 1379 (US); Oktibbeha Co., Starkville, Tracy 18 July 1894 (US); Panola Co., Pleasant Grove, Mackenzie 351 (KSC); Perry Co., 14 miles west of Beaumont, Webster & Wilbur 3405 (MICH); Rankin Co., 3 miles east of Brandon, Webster & Wilbur 3351 (MICH); Wilkinson Co., 3 miles west of Rosetta, Webster & Wilbur 3280 (MICH).

MISSOURI: Barry Co., near Eagle Rock, Palmer 31453 (MO); Bollinger Co., 1 mile north of Glen Allen, Steyermark 14096 (MO); Butler Co., Poplar Bluff, Eby July 1893 (MO); Callaway Co., McCredie, Schwab (PENN); Camden Co., Zebra, Zirkle & Drouet 9 Aug. 1928 (UARK); Carter Co., Hunter, Thom 16 Aug. 1900 (NA); Crawford Co., 4 miles west of Bourbon, Bauer 205 (F); Dent Co., 5 miles nw. of Bunker, Steyermark 12360 (MO); Dunklin Co., Pine City, Bush 265 (MO, NY, US); Franklin Co., 7 miles west of Pacific, Shinners 11539 (SMU); Greene Co., Springfield, Standley 1536 (US); Howell Co., 4.5 miles northwest of Willow Springs, Steyermark 23461 (F, MO); Jasper Co., Webb City, Palmer 2607 (GH); Jefferson Co., Goldman,

Drushel 1901 (MO); Lincoln Co., 4 miles west of Foley, Steyermark 64820 (F); McDonald Co., 5 miles se. of Pineville, Steyermark 5593 (F); Maries Co., 1.5 miles west of Van Cleve, Steyermark 27561 (F); Miller Co., between Ulman and Hawkeye, Brown 12 July 1916 (MO); Montgomery Co., east of Mineola, Drouet 95 (MO); Oregon Co., 3 miles northwest of Greer, Steyermark 12335 (MO); Osage Co., 5 miles northwest of Freeburg, Steyermark 27684 (F); Ozark Co., north and northwest of Tecumseh, Steyermark 66329 (F); Perry Co., about 3 miles south of Perryville, Steyermark 13968 (MO); Phelps Co., Rolla, Coe Sept. 1903 (GH); Polk Co., Bolivar, Trelease 479 (MO); Pulaski Co., 2 miles south of Cookville, Steyermark 4851 (F); Randolph Co., Mt. Arcey, Englemann July 1863 (MO); Ripley Co., near Pender, Palmer & Steyermark 41615 (MO); St. Charles Co., between Augusta and Klondike, Steyermark 19471 (MO); St. Genevieve Co., without exact locality, Mathias 26 July 1925 (MO); St. Louis Co., Forest Park in St. Louis, Eggert 23 July 1878 (F, GH, MO, NY, PENN, US); Shannon Co., along branch of Big Creek, Steyermark 12398 (MO); Stoddard Co., Bernie, Bush 258 (MO); Stone Co., near Reed Springs, Palmer & Steyermark 42088 (MO); Taney Co., Swan, Bush 727, (MO); Wright Co., 2 miles southeast of Cedar Gap, Steyermark 23725 (F, MO).

ARKANSAS: Benton Co., without exact locality, Plank 1899 (NY); Clark Co., Okalona, Demaree 17820 (F); Craighead Co., Jonesboro, Demaree 3699 (MO, UARK); Drew

Co., Monticello, Demaree 17655 (F, MO, NY); Garland Co., Hot Springs, Scully 1070 (NY); Greene Co., Beach Grove to Lafe, Demaree 4052 (UARK); Lafayette Co., Lewisville, Fisher 6 July 1923 (DUKE); Logan Co., Magazine Mt., Moore 420102 (UARK); Marian Co., Yellville, Moore 350123 (TEX, UARK); Polk Co., Mena, Palmer 12632 (MO, US); Pope Co., Nogo, Merrill 545 (TEX, UARK); Pulaski Co., Little Rock, Vasse (MO); Scott Co., 6 miles s. of Waldron, Rose 16 June 1941 (OKLA); Sharp Co., Ash Flat, Perryman 16 July 1931 (UARK); Washington Co., Fayetteville, Moore 460136 (UARK).

LOUISIANA: Grant Parish 15 miles south of Winnfield, Webster & Wilbur 3259 (MICH); Lincoln Parish, Ruston, Cocks July (NO); Orleans Parish, New Orleans, Drummond (GH); Rapides Parish, north edge of Pineville, D. S. & H. B. Correll 9842 (DUKE).

KANSAS: Cherokee Co., without exact locality, Hitchcock Aug. 1896 (KSC); Riley Co., Manhattan, collector not stated (NY).

OKLAHOMA: Otooka Co., 0.25 miles nw. of Limestone Gap, Butler 21 July 1877 (MO); Bryan Co., Bennington, Palmer 10437 (MO, US); Caddo Co., between Fort Cobb and Fort Arbuckle, Palmer 188 (NY, US); Carter Co., Ardmore, Palmer 10398 (MO, US); Cherokee Co., 6 mi. ne. of Tahlequah, Waterfall 10184 (OKLA); Choctaw Co., 1 mile west of Fallon, Cory 57434 (OKLA); Delaware Co., west of

Siloam Springs, Ark., Waterfall 9186 (OKL, OKLA); Haskell Co., Sans Bois Mts., Sheldon 117 (US); Leflore Co., near Page, Blakley 1495 (GH, MO); McCurtain Co., 11 mi. s. of Bethel, Waterfall 7646 (OKL); Murray Co., 2 miles east and 2 north of Sulphur, Waterfall 6527 (MO, OKL); Muskogee Co., 2 miles east of Braggs, Waterfall 9646 (OKLA); Oklahoma Co., 2 miles n. and 1 e. of Newalla, Waterfall 3082 (OKL); Okmulgee Co., Okmulgee, Walton 26 (OKLA); Pushmataha Co., Antlers, Palmer 8315 (MO, MT, NY, US); Pottawatomie Co., 20 miles south of Shawnee, Negahnquet 20 July 1948 (OKL); Sequoyah Co., 9 miles west of Fort Smith, Ark., Bigelow 1853-54 (US).

TEXAS: Cass Co., n. of Atlanta, McClung 15 June 1926 (TEX); Gregg Co., Gladwater, Reverchon June (MO); Harris Co., Houston, Emig 123 (MO); Harrison Co., Marshall, Bush 637 (MO); Jasper Co., Kirbyville, Tharp 23 Aug. 1941 (GH, TEX); Lamar Co., 13.5 miles north of Paris, Cory 57431 (OKLA); Nacogdoches Co., Nacogdoches, Parks 25 July 1942 (TAES); Newton Co., without exact locality, Tharp 23 July 1939 (TEX); Robertson Co., Calvert, Hopkins July 1889 (US); Smith Co., Swan, Reverchon 3120 (MO, SMU); Tyler Co., Woodville, Fisher 32127 (F); Wood Co., Mineola, Reverchon 8 July 1902 (MO).

This species is by far the most familiar representative of the genus because of its wide range, the greatest of any in the genus, and also because of the fre-

quency with which it is encountered throughout most of that range. Its distinctive features are so obvious and clear-cut and have been so uniformly well understood even from the time of its original publication, based upon a specimen collected by Kalm "in Virginia," that it is rarely found misidentified in herbaria. These characteristic features are the conspicuous tetragonal stem, the corners of which are strikingly membranous wing-margined, the typically opposite branches, the ovate-clasping leaves, the rose or pink corolla (although albinos are encountered rather rarely), and the shallow calyx tube, the venation of which, although often slightly elevated, is not developed into a heavy costa. None of these characteristics alone is enough to distinguish the species but the combination of them in one plant is unique. In the western part of the range of S. angularis, it has been confused surprisingly often with S. campestris. The latter species may be readily distinguished from the former by its typically alternate branches and especially by the turbinate and comparatively long calyx tube with strongly developed costae. In the southeastern region, it has been confused at times with S. brachiata, but is at once separable from that species because of its almost terete lower stem and oblong, nonclasping leaves.

The species is remarkably uniform throughout its range. None of the trivial variants designated previously are here deemed worthy of recognition nor have any others been discovered. Although I have not seen even a photograph of the type of Chironia angularis β angustifolia, if

it is still extant, I am accepting the past interpretation for the time being that this entity is what is now called S. brachiata. Coordinate with this variety, Michaux published C. angularis d latifolia which is perhaps the typical element of S. angularis. The species remained unencumbered by the designation of minor varieties until the time of Rafinesque. That author (1830), after describing S. angularis, stated that "it has some varieties: 1. Albiflora. 2. Latifolia. 3. Pauciflora. 4. Elatior." None of these propositions are discussed or mentioned by him further in any manner and hence are merely nomina nuda. Therefore they are not available for transferral to any other rank. House, in providing formal nomenclature to designate the albino form, erred in transferring a name which "has no status under the Rules." For those who find it useful or satisfying to name such striking minor variations the epithet for the albino might best be written as Sabatia angularis forma albiflora House. Fernald described a teratological specimen as Sabatia angularis forma cleistantha. It has not been seen again in any of the many hundreds of sheets of this species that I have examined. The branches are stunted and malformed bearing sessile or nearly sessile flowers which are aborted and modified in size and form as to be scarcely recognizable as flowers. Little is to be gained by formal designation of such rare chance monstrosities.

4. Sabatia quadrangula sp. nov.[1]

Sabbatia cymosa (Lam.) G. Don, Gen. Hist. 4:207. 1838, as to description but excluding synonym. Sabbatia paniculata in the sense of authors after 1860 but not Michx. or Pursh.

Sabatia brachiata Ell. f. candida Fern., Rhodora 39: 443. 1937.

Erect annual (15)25--45(75) cm. high, usually with but 1 stem arising from each rosette, but occasionally with two to several. Branches usually restricted to upper one-quarter or one-third of stem, occasionally arising from nodes of the upper half of the stem or rarely from even the lowermost nodes, usually rather strongly ascendent, forming an angle of 15--30 degrees, or occasionally up to 60 degrees; typically opposite along the stem and principal branches, the ultimate ramifications more commonly alternate, the branches forming flat-topped or convexly-corymbose loose to compact crown. Stem strongly quadrate, conspicuously so below, 1--2(3) mm. in diameter, strikingly although finely membranous wing-angled, these wings thin, very low, less than 0.5 mm. in height in the lower portion of the stem and reduced above to the merest trace or even fine ridge. Roots few to more typically numerous, slender,

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[1]Sabatia quadrangula sp. nov. Herba annua et rosulata, caulibus quadrangularibus, ramis oppositis, pedicellis brevibus, 1--2(4) mm. longis, corolla alba, 5-partita. Specimen typicum legit R. Wilbur (n.2899) prope Durham, in Carolina Septentrionali, et in Herb. Universitatis Michiganensis conservatum.

fibrous, usually widely spreading and shallowly situated, about 4--8 cm. long and less than 1 mm. in diameter. Basal rosette may or may not be present at time of flowering, even when present often not well-developed or conspicuous, when well-developed of spreading obovate to spatulate, obtuse to occasionally acute leaves tapering to an almost petiolate base, about 2--4 cm. long and 1.8 cm. wide. Cauline leaves membranous, ascendent, 3-nerved, or only 1-nerved in smaller leaves, somewhat revolute, (0.8)1.6--3.2(5.8) cm. long, (3)4--8(18) mm. wide, obtuse to acute, typically apiculate, usually narrowly to broadly linear to oblong or lanceolate, usually about 3--5 times as long as broad but ranging from about 2--8 times as long as broad, typically at least with the lowermost with a strongly clasping base. Internodes often equalling or slightly exceeding the leaf, commonly about 1--2 times as long, but ranging from 0.5--5 times as long as the leaves. Inflorescence of corymbosely to pyramidally arranged cymules, either 1, both or none of whose lateral branches may be surpressed, flowers unusually closely associated in the cymule as the pedicels are always short, the flowers being often sessile or nearly so, pedicels usually not more than 1--2 mm. in length, always less than 4 mm. long. Calyx tube thin, 5 ridge-angled, about one-half as long as the corolla tube, or about 2--3 mm. high, broadly turbinate, 1.5--3(3.5) mm. long. Calyx lobes thin, narrowly linear, (2)4--8(11) mm. long, usually about 0.5 mm. or less in width, but very rarely lobes as broad as 1.5 mm., erect in

bud, and apparently ascendent at anthesis arching upward between the corolla lobes, which usually exceeded them by 2--5 mm. Corolla tube (2.5)4--5(7) mm. long, white but apparently greenish as ovary is visible through the thin translucent wall. Corolla lobes usually oblong, or spatulate, or somewhat elliptic, usually obtuse but not uncommonly acute, (4.5)6--12(15) mm. long, (1.5)3--4(6) mm. wide, spreading, pure white, occasionally with or more commonly without the basal yellow patch, often turning saffron-yellow upon drying, especially along the reticulate venation pattern. Filaments slender, white, 2--4 mm. long; anthers pale-yellow, 1.5--3 mm. long. Stigmatic lobes greenish, lanceolate to oblong, 2--4 times the length of the white style, 0.5--1.5(2) mm. long. Capsule cylindrical 4.5--7 mm. long, 3--4 mm. in diameter.

Type locality: about four miles northeast of Durham, Durham County, North Carolina. Type: Wilbur 2899 (MICH).

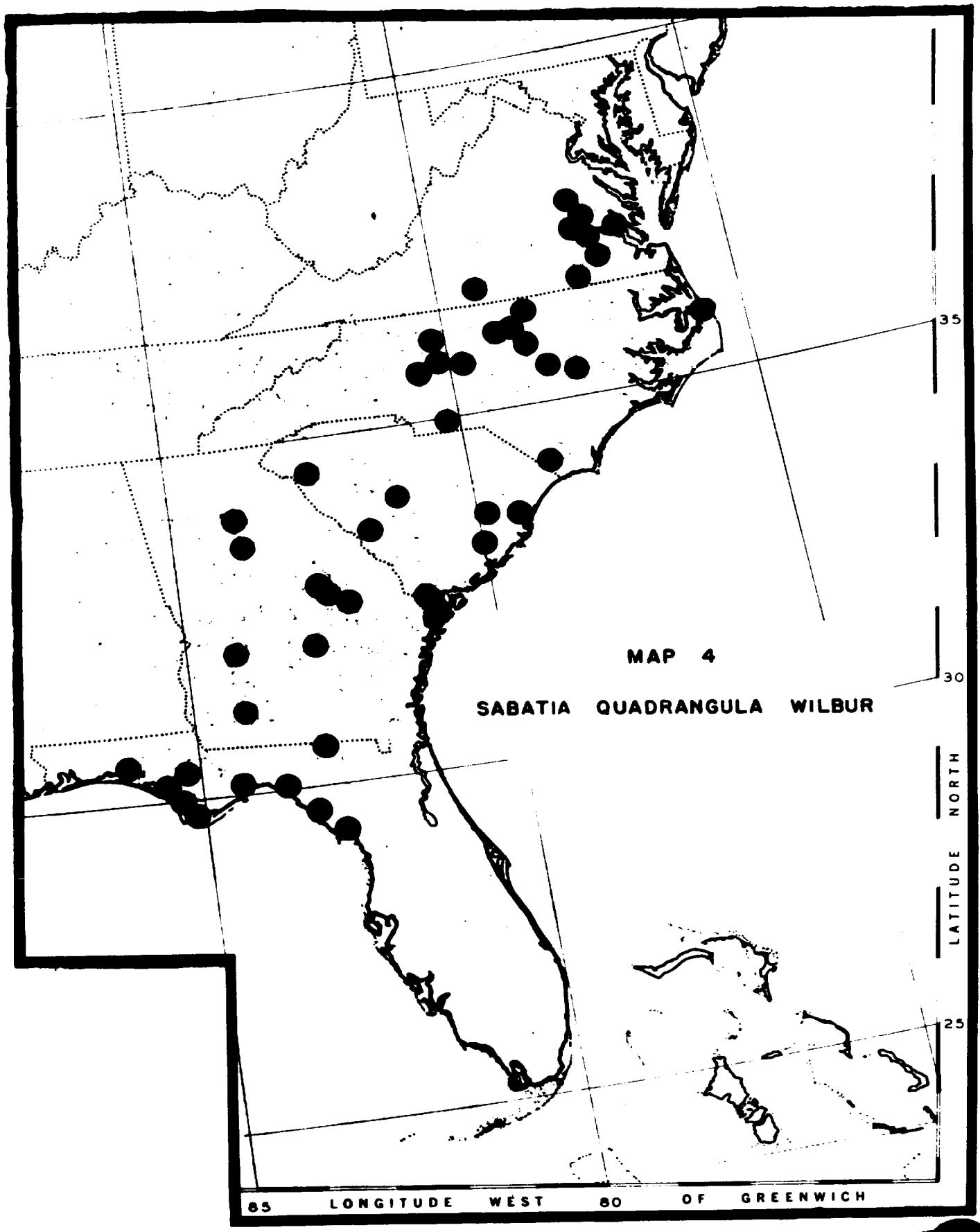
DISTRIBUTION. Fields, pinelands and drier savannas from southeastern Virginia south to central Florida.

SPECIMENS EXAMINED.

VIRGINIA: Chesterfield County, near Chesterfield Courthouse, Fernald & Long 6342 (GH); Greenville Co., northwest of Taylor's Millpond, Fernald & Long 10785 (GH, PENN); Hanover Co., 1 mile s. of Ashland, Ward 8 Aug. 1885 (US); Henrico Co., west of Elko Station, Fernald & Long 8818 (GH); James City Co., south of Hotwater, Fernald

MAP 4

Distribution of *Sabatia quadrangula* Wilbur



MAP 4

SABATIA QUADRANGULA WILBUR

& Long 8817 (DUKE, GH); Pittsylvania Co., Falls Creek, Heller 1105 (NY, US); Prince George Co., west of Prince George Courthouse, Fernald & Long 8816 (GH); Sussex Co., northeast of Homeville, Fernald & Long 6341 (GH, MO, NY, PENN, US).

NORTH CAROLINA: Anson Co., 6 miles w. of Wadesboro, Smith 30 July 1884 (GH, US); Columbus Co., Nakina, Schallert 30 June 1928 (OKLA); Dare Co., Old Battle Ground, Bartley & Pontius 489 (NY); Davidson Co., High Rock, Schallert 8660 (DUKE); Durham Co., bout 4 miles northeast of Durham, Wilbur 2899 (MICH); Forsyth Co., without exact locality, Schallert 18 Aug. 1940 (MO, UARK, WIS); Granville Co., Oxford, Godfrey 5464 (DUKE, GH); Johnston Co., 0.5 mi. n. of Cox's Mill, Fox 4942 (MICH); Orange Co., Hillsboro, Gray & Carey July 1841 (GH); Randolph Co., Asheboro, Hood 2399 (FLAS); Rowan Co., vicinity of Salisbury, Heller 130 (F, MO, NY, PENN); Wake Co., just west of Morrisville, Godfrey 49518 (DUKE, FLAS, GA, GH, MICH, NCS); Wayne Co., Goldsboro, Burlingame July 1887 (BRU).

SOUTH CAROLINA: Aiken Co., Vancluse, Eggert 6 Aug. 1898 (MO); Anderson Co., Long Branch Church, Davis 29 July 1919 (MO, TEX, US); Beaufort Co., Bluffton, Mellichamp 1884 (F, US); Berkeley Co., 8 miles south of Monks Corner, Wiegand & Manning 2557 mixed sheets (CU, GH); Georgetown Co., 12 miles north of Georgetown, Godfrey & Tryon 26 (DUKE, F, GH, MO, NY, US); Jasper Co., Ridgeland, Mohr 1893 (MO);

Lexington Co., 8 miles south of Columbia, Godfrey & Tryon 1229 mixed sheet (NY); Williamsburg Co., Lanes Station, Burlingame 20 July 1894 (BRU).

GEORGIA: Emmanuel Co., near Graymont, Harper 990 (GH, NY, US); Gwinnet Co., between the Alcovy River and No Business Creek, Small 14 July 1893 (F, GH, MO, NY, US); Johnson Co., 2.5 mi. w. of Wrightsville, Pyron & McVaugh 3083 (GA); Mitchell Co., few miles east of Pelham, Thorne 5078 (CU); Newton Co., 4 miles north of Covington, Pyron & McVaugh 3036 (GA, NA); Sumter Co., without exact locality, Harper July 1897 (NY); Telfair Co., McRae, Biltmore Herb. 4511 (US); Washington Co., 3 miles north of Harrison, Pyron & McVaugh 3104 (NA, NY).

FLORIDA: Bay Co., Panama City, Knight 6 July 1943 (FLAS); Calhoun Co., without exact locality, Chapman (MO); Dixie Co., near east limits of Jena, Beaman 280 (MICH); Franklin Co., Apalachicola, Chapman (GH); Gulf Co., north of Port Saint Joe, Small, DeWinkeler & Mosier 11 July 1924 (DUKE, FLAS, GH, MICH, MO, NCU, NY, PENN, TENN, WVA); Levy Co., Rosewood, Garber June 1876 (BRU, F, NY); Hamilton Co., near Jennings, Bright 3902 (WIS); Taylor Co., between Perry and the Gulf of Mexico, Small, Small & DeWinkeler 11452 (NY, US); Wakulla Co., prope St. Marks, Rugel May 1843 (MO, US); Walton Co., Freeport, Mohr 18 June 1880 (US).

This species has been known rather generally for almost one hundred years as Sabatia paniculata. This name, based upon Chironia paniculata Michx., has long been a source of confusion and has been applied by various authors to three different species. For the past century its application has been rather consistently restricted to the species which is here called S. quadrangula.

Michaux's original description in full is as follows:

> paniculata. C. firmiter erecta: foliis lanceolato-linearibus: panicula multiflora, brachiata, subfastigata; calyce subulato, corolla semibreviore
>
> Obs. Caulis lineis 4 prominulis quasiquadrangulus: folia inferiora interdum ovali-lanceolata; suprema subulato-setacea. Corollae laciniae oblongae.
>
> Hab.: in Georgia et Carolina.

To be sure, there is very little descriptive information here that would be sufficient to allow even someone quite familiar with the genus to be certain or even relatively confident as to which entity Michaux was attempting to characterize. Many of the phrases such as "C. firmiter erecta...panicula multiflora, brachiata, subfastigata: calyce subulato, corollae semibreviore....Corollae laciniae oblongae" might be applied with equal propriety to several other species. Of the five species included by Michaux, the flower color of the four others is described as being rose; that of C. paniculata is not given. Those characters of the leaf that were mentioned are rather indicative of S. difformis ("...foliis lanceolato-linearibus...folia

inferiora interdum ovali-lanceolata; suprema subulato-setacea..." The features of the stem described in the original diagnosis especially "caulis lineis 4 prominulis quasi quadrangulus..." are also a much more apt description of the stem of S. difformis with its four elevated lines or ridges in the upper portion of the stem than it is of the very strikingly 4-sided stem of S. quadrangula.

It was not surprising, therefore, to find that the photograph of Michaux's collection was without doubt a specimen of S. difformis. This species is a perennial with a large rhizome; the stem below is terete or with four lines or ridges superimposed upon it, and above the stem becomes somewhat quadrangular; the leaves are ovate-lanceolate, lanceolate, linear to setaceous with gradual modification from the base to the inflorescence; the corolla lobes are often 5 mm. or more longer than the longest lobes observed in S. quadrangula. The specimen in Michaux's herbarium, as is shown by the photograph at the Gray Herbarium, is excellent, and most of these features may be observed or interpreted from it. The underground portion of the plant, to be sure, is lacking. It is obvious that the lowermost part of the specimen (which can be seen even from the photograph to be terete or nearly so and approximately twice the diameter of the largest stem of the species that has most recently passed as S. paniculata) has been broken from a very substantial underground structure. Therefore Chironia paniculata is, both on the basis of its original diagnosis

and upon the photograph of the specimen in Michaux's own collection in Paris, merely a later synonym for Swertia difformis L. (1753), Chironia lanceolata Walt. (1788), and Chironia cymosa Lam. (1791).

Michaux's name was taken up by Persoon (1805), and Muhlenberg (1813) also listed it in his Catalogue with Walter's prior name listed under it as a synonym. These were relatively uncritical compilations, for Muhlenberg also listed Swertia difformis five pages later and even named C. venosa with but a few words of "diagnosis" that are enough to indicate that this again was what is now known as S. difformis. Pursh (1814), was one of the last to understand the limits of the species and also the arrangement of the synonymy. He transferred Michaux's epithet to Sabatia (as Sabbatia) listing Swertia difformis as a synonym, stating by way of explanation that this species "certainly is the long long Swertia difformis, as the specimens in the Herbarium of Sir Joseph Banks, sufficiently prove." Pursh also formally named as varieties the broad- and narrow-leaved forms of this species with C. lanceolata Walt. as a synonym of the latter. Elliott (1817) rather hopelessly confused the names of the white-flowered sabatias and the influence of his splendid Sketch was rather long-lasting. The very different S. brevifolia Raf. (= S. elliottii Steud.) was very well described, no doubt for the first time, but was called S. paniculata with the following note by was of explanation: "Though the description of Michaux applies

more peculiarly to the S. corymbosa [S. difformis], yet as this species was definitely included, and is the only one to which the term paniculata is correctly applicable, I have referred to him here." This freedom of interpretation on the part of Elliott caused confusion that persisted for many years. From 1817 until the appearance of Grisebach's monograph (1839), the confusion among the white-flowered sabatias was little recognized. Grisebach pointed out the confusion but apparently felt that it would be best to apply the name S. paniculata in the sense of Elliott, who had been followed by all American authors, and to adopt the name S. corymbosa for the perennial species. His synonymy showed complete understanding of the propositions that had been made for this last-mentioned entity since the names of Linnaeus, Walter, Lamarck, Michaux, Pursh, and finally Baldwin (or Elliott) are arrayed there. It seems probably that he also included the opposite-branched annual, here called S. quadrangula, in the same concept, as an apparent duplicate of the specimen of Beyrich cited by him under S. corymbosa is the earliest known collection of S. quadrangula known to me. Chapman (1860) was the first to define S. paniculata in the sense that it has been applied in recent times. His action in this, as in most other matters, was heavily influenced by Gray as is shown from a letter (in the National Herbarium, dated December 1883) from Chapman to Dr. J. H. Mellichamp which is here quoted in part.

> ...I well remember the quarrel Gray and I had over it, I contending that the one we now call S. elliottii, our really only paniculate species, should bear that

name. However, for the sake of uniformity as to our northern and southern Floras, I yielded.

The appearance of the Synoptical Flora (1878) definitely established the usage of S. paniculata as the name of the white-flowered, opposite-branched annual and this name has been so applied since that date.

Rafinesque (1830) published Sabbatia nivea which in some ways strongly indicates this species. The name has never been identified and I am at a loss to know what species Rafinesque had. Sabbatia nivea was described by him as having snowy-white, trichotomous flowers, a four-angled stem and oblong leaves, which all would indicate S. quadrangula more strongly, however, than any other species. The species was, however, definitely stated to have been discovered by him in eastern Kentucky near the Cumberland River. There is no species known to me from that area which matches his description. Therefore, the name must still remain an unsolved problem.

G. Don (1838) transferred Lamarck's C. cymosa to Sabatia applying it to what is here called S. quadrangula. This usage was not followed by any other author. The photograph of the specimen upon which Lamarck's species was based is again what is now known as S. difformis.

Gray (1878) placed S. paniculata var. latifolia Pursh under the synonymy of what is now considered S. difformis but placed S. paniculata var angustifolia Pursh in synonymy with the species which I am calling S. quadrangula and which he called S. paniculata. In other words

he felt that Pursh was including two species under S. paniculata. Gray also implied that Michaux had done so as well. I am aware of no evidence that has been presented that would warrant such a conclusion.

The only name that has been published previously for this species, whose identity has been for so long known to American botanists, is S. brachiata Ell. f. candida Fernald. This name must be assigned to the synonymy of S. quadrangula rather than to S. brachiata as the type specimen, Fernald & Long 6346, is not an albino of S. brachiata as claimed by Fernald, but rather the white-flowered species, S. quadrangula. This is shown by the lower portion of the stem which is strongly quadrate with conspicuously membranous-margined angles and by the short pedicels 2mm. or less in length. The only specimen cited by Fernald besides the type was Seymour 33 which came from Sussex County in southeastern Virginia as did the type collection of Fernald's form. Seymour's plant, seen only at the Gray Herbarium, is S. brachiata as indicated by the stem being terete below and some of the pedicels being over 5 mm. long and many of them over 2 cm. long. The flowers are bleached on the herbarium specimen but, as the sheet was originally determined as S. paniculata, they were very likely white. I also have seen white-flowered specimens of S. brachiata in the field. Since the designated type of Fernald's form, however, is what is here called S. quadrangula, it will be necessary for those who feel it useful to designate formally such minor variations to provide another name for albino plants of S. brachiata.

Fernald's name could have been elevated to specific rank (for the annual species with a quadrate stem) instead of providing an entirely new name. This procedure would seem undesirable as Fernald's intention in describing the form is clear; his choice of type was unfortunate. It would seem to me unwise, although perfectly possible, to encumber this species with a name not in accord with the author's clearly stated intention. Besides this consideration, isotypes are not available for that number. Therefore, a new name has been provided and a type of which there are many duplicates designated.

5. Sabatia brachiata Ell.

? Chironia angularis var. β augustifolia Michx., Fl. Bor.-Am. 1: 147: 1803.

Sabbatia brachiata Ell., Sk. Bot. S. C. & Ga. 1: 284. 1817.

Sabbatia concinna Wood, Class-Book ed. 2. 451. 1847.

Sabbatia augustifolia (Michx.) Britton, Mem. Torr. Club 5: 259. 1859.

Erect annual (10)25--50(67) cm. tall, usually but 1 stem arising from each rosette, more rarely with 2 or 3. Branching usually restricted to the upper one-third or half of stem but in more robust plants sometimes arising from the lowermost nodes, usually rather strongly ascendent, rarely spreading to as much as 70 degrees, typically opposite, although rarely alternate, along main stem or principal

branches, or the ultimate somewhat more commonly alternate, forming convexly corymbose or somewhat pyramidal loose to compact crown. Stem 1--2(4) mm. in diameter, terete, conspicuously so below and smooth, not wing-angled, although sometimes noticeably lined or finely ridged. The stem above and upon the branches becoming subquadrate or even quadrate and bearing very slight wings at the angles. Roots few to numerous, slender, fibrous, spreading or descendent, about 4--8(10) cm. long, 0.5--1.5 mm. in diameter. Basal rosette typically present at time of flowering, usually conspicuous, typically composed of numerous overlapping, spreading usually broadly spatulate, rarely elliptic, obtuse to seldom acute leaves tapering strongly to an almost petiolate base, 8(15--30(45) mm. long, (6)10--14(18) mm. wide. Cauline leaves membranous, ascendent, 3-nerved, or rarely only 1-nerved in smaller leaves, (1)1.5--3(4.5) cm. long, (3)4--10(16) mm. wide, often obtuse especially below, or acute, commonly slightly callose-apiculate tipped, oblong, with more or less parallel margins, or more rarely elliptic or somewhat lanceolate, tapering somewhat to base, at least usually not strongly or broadly clasping. Internodes usually about 1.5--3 times longer than the leaves, but ranging from but about three-fourths to about four times as long as the leaves. Inflorescence of corymbosely to pyramidally arranged cymules either 1, both, or none of whose lateral branches may be surpressed. Pedicels 5-sided, noticeably thin-ribbed, (1)2--8(13) mm. long. Calyx tube thin, noticeably but finely 5-ribbed, usually about half as long as the corolla

tube, (1)1.5--3(4) mm. long, turbinate to campanulate. Calyx lobes thin, narrowly linear, (4)7--10(15) mm. long, 0.3--1.0 mm. wide, ascendent in bud, wide-spreading at anthesis, usually exceeded by the corolla lobes by 3--8 mm. Corolla tube (3)4--5(6) mm. long, 1.5--3 mm. in diameter, cylindrical, greenish within and without. Corolla lobes oblong, or narrowly to broadly spatulate, usually obtuse, or occasionally tapering to an acute apex, (5)7--14(20) mm. long, (2)3--6(8) mm. broad, wide-spreading, at anthesis. pale-pink to darker roseate, rarely white, with low triangular greenish-yellow to yellow area at base of lobe, usually bordered by reddish line. Filaments slender, pale-yellow to nearly colorless, (1.5)2--3(4) mm. long; anthers bright-yellow, usually about 3 mm. long, 2--4 mm. in length. Stigmatic lobes slender, (2)3--5(7) mm. long; style 2--4 mm. long, usually less than the stigmatic branches in length. Capsule cylindrical, 5--8 mm. high, 3--4.5 mm. in diameter.

Type locality: "Grows in the middle and upper country of Carolina. Near Columbia," Lexington Co., South Carolina. Type: Herbemont s. n. (CHARL!)

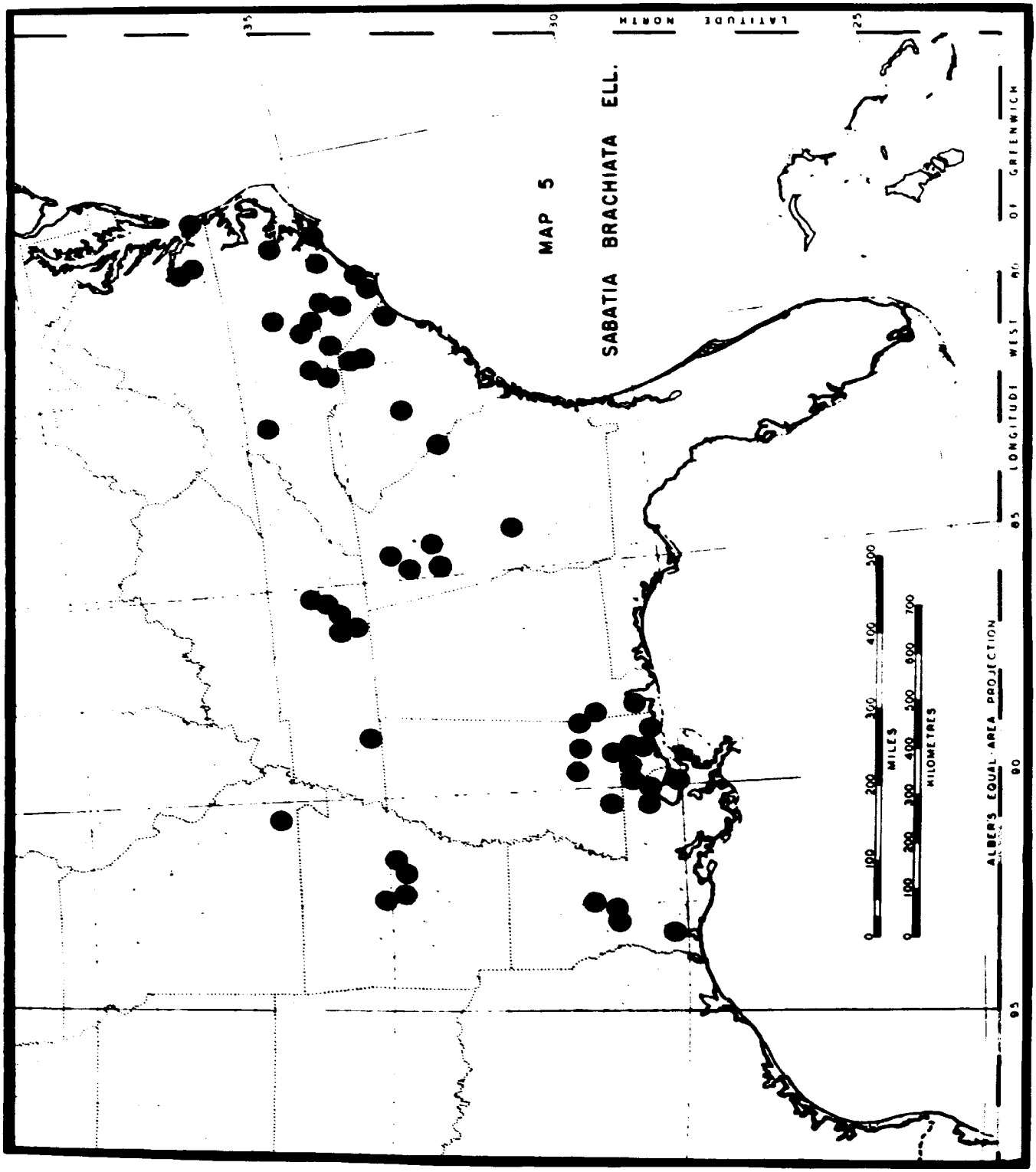
DISTRIBUTION: Fields, dry and open oak and pine woods ranging from southeastern Virginia south into Georgia and westward to southern Missouri and Louisiana.

SPECIMENS EXAMINED.

VIRGINIA: Princess Anne Co., Little Neck, Fernald & Long 4134 (GH, PENN); Prince George Co., just south of

MAP 5

Distribution of *Sabatia brachiata* Ell.


MAP 5
SABATIA BRACHIATA ELL.
LATITUDE NORTH
LONGITUDE WEST OF GREENWICH
ALBER'S EQUAL-AREA PROJECTION
MILES
KILOMETRES

Disputanta, Fernald & Long 8815 (GH); Sussex Co., northeast of Homeville, Fernald & Long 6344 (GH, NY, PENN, US).

NORTH CAROLINA: Anson Co., 4 miles north of Ansonville, Boyce 1127 (NCS); Beaufort Co., 7 mi. south of Washington, Godfrey 4400 (GH, US); Brunswick Co., 3 miles north of Bolivia, Wilbur 2888 (MICH); Bladen Co., without exact locality, Biltmore Herb. 4511a (GH, MO NCU, NY, PENN, US); Carteret Co., 3 miles southeast of Newport, Godfrey 48192 (NCS); Cumberland Co., 7.5 mi. n. of Fayetteville, Godfrey & Fox 49446 (DUKE, NCS); Harnett Co., 6 miles east of Cameron, Fox 2546 (NCS); Montgomery Co., 1 mile north of Ether, Wiegand & Manning 2543 (CU); Moore Co., 2 miles s. of West End, Fox & Whitford 3903 (MICH, NCS); New Hanover Co., Wilmington, McCarthy Aug. 1885 (US); Onslow Co., at Richlands, Godfrey 4475 (GH, US); Sampson Co., Roseboro, Godfrey 4532 (DUKE, GH, US); Scotland Co., 12 mi. n. of Laurinburg, Godfrey 5046 (DUKE, GH, US); Wake Co., Raleigh, Godfrey 4918 (GH, NCU, NY); Wilkes Co., up Pores Knob, Radford & Stewart 1743 (NCU).

SOUTH CAROLINA: Chesterfield Co., near Cheraw, Ward 25 June 1895 (NY, US); Darlington Co., Society Hill, Canby July 1878 (F, NY); Horry Co., without exact locality, Adams 30 (PENN); Lexington Co., 8 miles south of Columbia, Godfrey & Tryon 1229 (GH, NY-a mixed sheet, US).

GEORGIA: Bartow Co., 1.25 miles e. of Emerson, Duncan 8548 (GA, MO); DeKalb Co., northern slope of Stone

Mountain, Small 17 July 1893 (F, NY); Douglas Co., 10 miles s. of Douglasville, Duncan 3648 (MICH); Pickens Co., near Jasper, Biltmore Herb. 4511a (US); Richmond Co., Augusta, Cuthbert Aug. 1876 (RUT); Taylor Co., without exact locality, Pyron 3 Aug. 1930 (DUKE).

TENNESSEE: Coffee Co., near Manchester, Clebsch & Clebsch 4770 (TENN); Franklin Co., between Tullahoma and Estill Springs, Svenson 9211 (GH); Grundy Co., east of Altamont, Svenson 7137 (GH, TENN); McNairy Co., without exact locality, Bain 431 (GH, NY); Van Buren Co., Falls Creek State Park, Shanks, Clebsch & Sharp 3431 (MICH, TENN); White Co., sw. of Clifty, Shanks, Clebsch & Sharp 2916 (TENN).

ALABAMA: Mobile Co., about 8 miles southwest of Mobile, Webster & Wilbur 3479 (MICH); Washington Co., Fruitdale, collector not stated July 1904 (MO).

MISSISSIPPI: Covington Co., 1.5 mi. se. of Mt. Olive, Webster & Wilbur 3308 (MICH); Forest Co., about 14 miles south of Hattiesburg, Webster & Wilbur 3397 (MICH); Harrison Co., 3 miles south of Saucier, Webster & Wilbur 3442 (MICH); Jackson Co., Ocean Springs, Pollard 1083 (MO, NY, US); Jones Co., Laurel, Tracy 3356 (NY); Pearl River Co., Poplarville, Tracy 1687 (GH, US); Pike Co., Holmesville, Wheeler (MO); Stone Co., 8 miles south of Wiggins, Webster & Wilbur 3440 (MICH); Wayne Co., 6 miles nw. of Ala.-Miss. state line, Sargent 18 June 1950 (OKL, NCS).

MISSOURI: Butler Co., 12 miles north of Poplar Bluff, Steyermark 11593 (MO).

ARKANSAS: Faulkner Co., Conway, Haas 1629 (US); Drew Co., Ladelle, Demaree 22321 (MO, OKLA); Lonoke Co., Grand Prairie, Demaree 22333 (MO, NY, OKL, OKLA); Prairie Co., DeValls Bluff, Demaree 22176 (MO); Pulaski Co., near Little Rock, Carpenter, June 1938 (UARK).

LOUISIANA: Calcasieu Parish, Lake Charles, Daves Aug. 1888 (F); Grant Parish, 4 miles south of Pollock, Webster & Wilbur 3257 (MICH); Orleans Parish, New Orleans, Drummond 224 (GH, K); Rapides Parish, 12 miles southeast of Hineston, Webster & Wilbur 3275 (MICH); St. Tammany Parish, vicinity of Covington, Arsene 11741 (US); Tangipahoa Parish, 6 miles east and 1 mile north of Hammond, Nease 1945 (OKL); Vernon Parish, 2 miles west of Leander, Webster & Wilbur 3228 (MICH); Washington Parish, Bogalusa, Cocks 5 June 1917 (NO).

This well-marked species has been rarely confused with any other except occasionally with specimens of S. angularis or the plant that has been most recently called S. paniculata. Both of these last-mentioned species are readily distinguished from S. brachiata by their strongly tetragonal stems whose angles are strikingly membranous winged. S. brachiata is strongly contrasted to those two species by possessing, especially below, a smooth, terete stem. Above and on the branches the stem is somewhat finely

ridged and angled but not conspicuously so. The corolla of S. brachiata is typically pink or rose and very robust specimens, especially in areas where S. angularis is more commonly to be expected, have been rather often mistaken for that widespread species. Albinos of S. brachiata are rarely encountered, but when they are found, or more commonly when the corollas become entirely bleached as they often do in drying, these plants are often mistaken for what has previously been called S. paniculata (= S. quadrangula). It may be well to point out again that the type of S. brachiata forma candida, which was originally collected and published by Fernald, is not S. brachiata, which normally has a rose-colored corolla, but S. quadrangula (S. paniculata in the sense of recent authors) which always has a white corolla. The identity of the type sheet can be determined with certainty; the lower portion of the stem is very distinctly quadrate with winged margins and pedicels are not more than 2 mm. long. These are both absolutely distinctive features of S. quadrangula. The only other specimen cited with the original description of this "form" was Seymour 33 which is definitely a specimen of S. brachiata. A new name will be required by those who feel it essential to designate formally such minor variations.

The short synonymy of this species is an indication of the excellence of Elliott's original description and the strong distinguishing characteristics of the plant itself. Chironia angularis β angustifolia of Michaux has been assigned to the synonymy of this species at least since the

appearance of the Synoptical Flora. Without seeing an authentic specimen from Michaux's herbarium, it is only tentatively that I place the name in synonymy with S. brachiata. The original characterization of the variety was very brief ("β angustifolia: foliis quasi lanceolatis; supremis etiam linearibus") and certainly states nothing that would exclude forms of S. angularis from consideration or would indicate clearly that the entity described was S. brachiata. Both this variety of Michaux's and his variety latifolia, which was formerly considered the sole element of his concept of S. angularis as now interpreted, were arranged under the generalized diagnosis of the species. The stem in that account of the species is stated to be "marginato-quadrangulus" and this would seem to exclude the entity now known as S. brachiata. Therefore it is with no evidence that I include Michaux's varietal epithet in the synonymy of S. brachiata. Perhaps Gray saw an authentic specimen at Paris and hence was correct in his treatment; in any event the question is yet to be settled. After Gray, the name was raised to specific rank by Britton, following the absolute rule of priority of the "American Code." This transfer was employed in many books and papers late in the last and early in the present century.

S. concinna is assigned to the synonymy of this species upon the basis of the original description which led Gray as early as 1856 to the same conclusion. It is perhaps of some significance that Wood himself (1861) also listed the name as a synonym of S. brachiata. The description

follows:

> 3. S. concinna. Wood. (Nov.sp.) Elegant Star Flower. St. Slender, subquadrangular, internodes 2--4 times longer than the leaves; branches opposite, sub-erect; lvs. linear and lance-linear, lower ones ovate, all acutish, sessile, panicle oblong; cal. segments linear, twice longer than the tube, twice shorter than the corolla; cor. 5-parted, segments oblong-obovate, obtuse, light purple.--Dry grassy prairies, Ia! abundant. Stem a foot high, few or many-flowered. Leaves 9--12" by 1--3", Flowers 15" diam., of a delicate blush purple, the star in the center yellow, bordered with green. Jl. Aug.

In the absence of an authentic specimen it is not completely satisfactory to assign this name to the synonymy of any species. The description is not that convincing. Merrill (Rhodora 50:127. 1948.) in discussing the unlisted names in Wood's publications, concluded that "it is the same as S. campestris Nutt., not S. brachiata Ell. as the latter species does not occur in Iowa; Wood's type was from Iowa." Wood described the branches as opposite and the calyx segments as only half as long as the corolla and these features would exclude from consideration anything but a most atypical specimen of S. campestris. If the plant were S. campestris it would hardly seem possible that the very peculiar and prominent costae of the calyx tube could be overlooked in even the most cursory examination. I have seen no specimen of S. campestris from Iowa. Merrill placed considerable weight upon the locality of the plant but his interpretation of the abbreviation "Ia." is certainly an error. In 1846 between the first and second editions of his Class-Book, Wood, enlarging the area to be covered by his flora, made a short collecting trip to Indiana. S. concinna was presumably

seen upon that trip. The explanation of geographical abbreviations appearing in the second edition informs one that "the names of...states...are often abbreviated, and always in the same manner as in other works; thus...Ia. or Ind., Indiana, &c." In this same edition (1847, p.3) the area of the flora was said to be "essentially the States lying north of the Ohio river and Maryland." One also learns in the "American Botanist and Florist" (1870, p.2.) that the "geographical limits of the present flora are the same as those adopted in the Class-Book: viz., all the States of the American Union lying east of the Mississippi River." Although the area covered by Wood's publications was, as we have seen, expanded in later years, they were never intended to cover the region west of the Mississippi River except indirectly. Wood meant Indiana by the abbreviation "Ia."

S. brachiata is not represented from Indiana in any of the herbaria that I have studied and neither it nor S. campestris were included by Deam in his Flora of that state. In fact, Deam (1940, p. 1080) after considering the evidence and after finding that that species was not represented in either the Gray Herbarium or in that of the New York Botanical Garden definitely excluded it from the known flora of the state. Fernald (1950) lists the range of the species as including southern Indiana. S. brachiata is not represented from Indiana, Illinois, or Kentucky in any of the collections that I have studied. The nearest known stations are in southeastern Missouri and Tennessee. The only two

species in Indiana known to Deam or vouched for by specimens examined by me are S. angularis and S. campanulata. A knowledge of the known ranges of the species in the genus does not solve the problem either as the presumed type locality fits neither of those species.

The description of the stem as being "subquadrangular" is also a bit puzzling if the name is really synonymous with S. brachiata for that species is very conspicuously marked by a decidedly terete stem in at least the lowermost portion. The upper part of the stem and the branches, however, do become rather strongly angled, and, if S. concinna is the same as S. brachiata, this explanation probably accounts for that at first puzzling statement in the description. The disposition of Wood's name, in the absence of authentic material, will always remain tentative, but the little evidence that is available certainly indicates that it was S. brachiata.

C. Subsection CAMPESTRES Blake

Neurola Raf., New Fl. 4: 92. 1838.

Subsect. Campestres Blake, Rhodora 17: 56. 1915.

Annual, branches typically alternate at least above. Basal rosette never present. Leaves either thin and membranous or thick and succulent, margins not scarious. Calyx tube conspicuously ribbed or costate by the prominent development of the fused lateral traces.

TYPE SPECIES: Sabatia campestris Nutt.

This subsection contains but two species which are obviously closely related to one another and which are strongly and uniquely distinguished from the other groups by the prominently developed calycine costae. In addition the typically alternate branching pattern sets this small group apart from subsection Angulares, to which it is probably most closely related and from whose progenitors it was very possibly derived. In addition the Angulares possess a very well-developed basal rosette at some stage in their life cycle although it is not always persistent until the time of flowering; the Campestres are never rosulate. An additional indication of this relationship, besides the aspect of the plants, the texture of the leaves, and perhaps the habit, is the common possession of a definitely quadrate stem whose margins are angled by a thin hyaline membrane.

The distribution of the Campestres is almost entirely west of the Mississippi River where they occupy an extensive area. The origin of the group, or at least the center of modern dispersal, may perhaps be assigned to the blackland prairies of northeastern Texas, whence it ranges extensively to the north, and to the east and south, and to some extent to the west. S. campestris accounts for the vast bulk of the subsectional range as S. arenicola is known only from the coastal fringe.

KEY TO THE SPECIES

A. Leaves and calycine lobes thin and membranous, neither succulent nor heavily cutinized; leaves broadest near the base, usually strongly clasping the stem, the midvein at least prominently elevated beneath; calyx lobes usually 2--6 times longer than the calyx tube, generally 4--8 times longer than broad; corolla lobes typically equalling or exceeding the calyx lobes, usually longer than 1 cm. and wider than 7 mm.; stigmatic lobes over 5 mm. long; anthers longer than 2 mm. Widespread in prairies and fields from Texas to Mississippi and north to Illinois and Kansas. . . . . 6. S. campestris

A. Leaves and calycine lobes thick and succulent heavily cutinized; leaves broadest above the base, tapering somewhat to the sessile non-clasping base, venation obscure and flush with the surface; calyx lobes usually less than twice the length of the calyx tube, generally less than four times as long as broad, corolla lobes usually equalled or exceeded by the calyx lobes, the corolla lobes usually less than 1 cm. long and narrower than 7 mm.; stigmatic lobes less than 5 mm. long; anthers shorter than 2 mm. Restricted to the strand and dunes from Louisiana southward into Mexico. . . . . 7. S. arenicola

6. Sabatia campestris Nutt.

Sabbatia campestris Nutt., Trans. Am. Phil. Soc. n. s. 5: 197. 1835.

Sabbatia nervosa Raf., New Fl. 4: 92. 1838.

Neurola arkanzica Raf., l. c., an alternate name.

Sabbatia formosa Buckl. Proc. Acad. Phila. 1862: 7. 1863.

Sabatia campestris f. albiflora Moore, Proc. Ark. Acad. Sci. 1: 26. 1941.

Erect annual (6)15--30(40) cm. high; stems 1--3 mm. wide, strongly quadrate throughout, the corners winged by a thin hyaline membrane, 0.1--0.2 mm. high. Branches usually few or absent from the lower half of the stem but when present sometimes opposite, typically alternate throughout, usually widely divergent, often forming angles of 60--90 degrees with stem, giving the plant a loose, strikingly divaricate or even geniculate aspect, or more rarely forming a fuller, more compact corymbiform crown, or in unfavorable situations sometimes unbranched. Root system of few to several fibrous roots or of a slender, fibrous tap-root usually 5--10 cm. long bearing several, slender, wiry laterals. Leaves thin, membranous, not in the least succulent or heavily cutinized, primary venation apparent even in living material and at least the midrib noticeably elevated on the lower surface, conspicuously 3--5 nerved in dried specimens, the lowermost rarely conspicuously different in either texture or shape from those at the

middle or upper nodes, except usually somewhat smaller in size, rarely persistent at anthesis (or very rarely quite different in being broadly elliptic to oblong, tapering to the base and up to 8 cm. long), above narrowly lanceolate to broadly so, or ovate-lanceolate, rarely somewhat oblong or even ovate, typically broadest at or very near the base, generally broadly clasping, usually those at the lower nodes obtuse while the upper are acute, the tip callose-mucronulate, (0.8)1.5--3.0(4.0) cm. long, (0.3)0.8--1.5(2.0) cm. wide, usually about (1)1.5--2(3) times as long as broad. Internodes (1)2--5(10) cm. long, usually about 1.5--4 times the length of the leaves. Inflorescence usually of loosely arranged, divergent, reduced, 1--2-flowered cymules forming a more or less open corymbose cluster. Peduncles (or pedicels) wiry, rigid, pentagonal, bearing fine hyaline membranous wings at the angles, (1)2--5(10) cm. long. Calyx tube broadly campanulate, usually about 1--1.5 times as long as broad, (3)4--6(8) mm. long; strongly pentagonal with 5 thin, membranous costae or ribs elevated about 1 mm. whose edges are finely hyaline margined. The intercostal tube very thin, membranous, translucent, appearing green due to ovary within. Calyx lobes thin, membranous, not heavily cutinized, strongly spreading at anthesis, (1.5)2--4(6) times longer than the tube, acute, apiculate, linear, (0.4)1.0--2.2(3.2) cm. long, usually 4--8 times longer than broad, strongly resembling the leaves in texture. Corolla tube usually 1--2 mm. longer than the calyx tube, colorless except for the extension of the yellow

"star" patches in the uppermost portion. Corolla lobes typically equalling or exceeding the calyx lobes, occasionally shorter, ascendent to rather strongly spreading, oblong, elliptical, or most commonly broadly obovate or spatulate, acute to obtuse, (1.0)1.3--2.0(2.3) cm. long, (0.4)0.6--1.3(1.5) cm. wide. rose to pale pink or rarely white with a 3--4 mm. by 1--1.5 mm. greenish-yellow patch at the base of the lobe, bordered by a white area and sometimes by a more densely roseate region. Anthers bright-yellow, narrowly linear, 2.5--5.0(6) mm. long; filaments white to pale-yellow, slender, 3--6 mm. long. Style slender, white to pale-yellowish, 3--4 mm. long; stigmatic branches greenish at first turning yellow at maturity, 5--8 mm. long. Capsules 5--9 mm. long, either equalling and included within the calyx tube or exserted about 2--4 mm.

Type locality: "in the open prairies of Arkansas and Red River." Type: Nuttall's collection presumably in the Herbarium of the Philadelphia Academy of Science, but not seen.

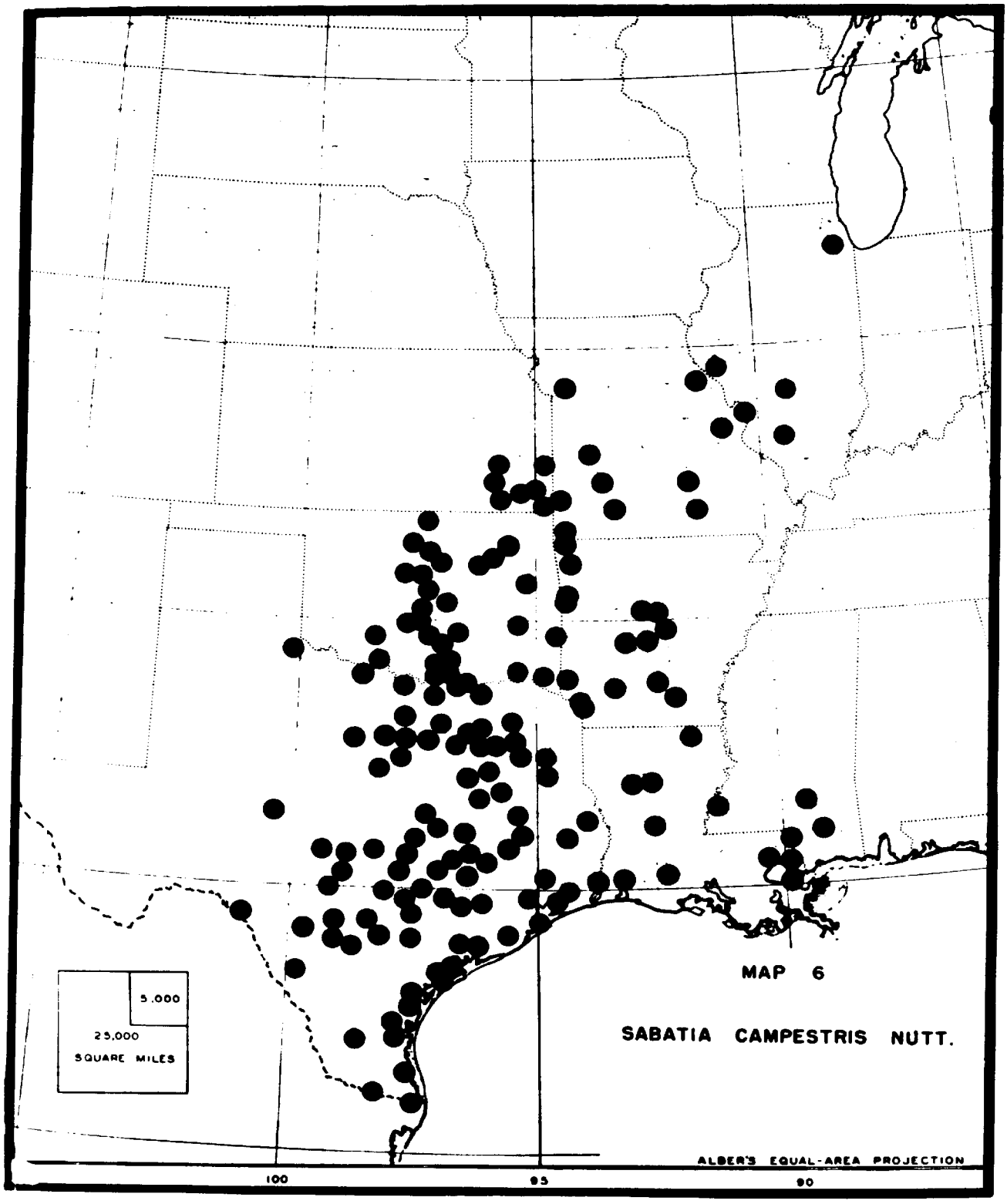
DISTRIBUTION: Fields and prairies from Illinois to Kansas south throughout most of the eastern half of Texas and eastward to Mississippi.

SPECIMENS EXAMINED:

ILLINOIS: DuPage Co., Hinsdale, Smith 497 (F); Montgomery Co., Fillmore, Young July 1885 (GH); Pike Co., without exact locality, Milligan Aug. 1883 (US); Washing-

MAP 6

Distribution of *Sabatia campestris* Nutt.


5,000
25,000
SQUARE MILES
MAP 6
SABATIA CAMPESTRIS NUTT.
ALBER'S EQUAL-AREA PROJECTION
100
95
90

ton Co., n. of Nashville, Eggert 13 Aug. 1898 (MO).

MISSISSIPPI: Adams Co., Natchez, Shimek June 1898 (F, MO); Covington Co., about 13 miles northwest of Hattiesburg, Webster & Wilbur 3359 (MICH); Forest Co., 0.2 miles south of Maxie, Webster & Wilbur 3438 (MICH).

MISSOURI: Christian Co., 2 miles south of Saunderds, Steyermark 23232 (F, MO, NY, TENN, WIS); Clay Co., Excelsior Springs, Duncan May 1908 (MO); Dent Co., northwest of Jadwin, Steyermark 19377 (MO); Donald Co., Anderson, Bush 24 July 1892 (MO); Franklin Co., se. of Pacific, Sherff 978 (F); Jackson Co., Sheffield, Bush 1843 (GH, MO, NY); Jasper Co., Carl Junction, Palmer 4 July 1903 (MO, NY, US); Pike Co., between Curryville and Vandalia, Bauer 1052 (F); Polk Co., 2.5 miles east of Eudora, Steyermark 24059 (F, MO); St. Clair Co., without exact locality, Bush 14938 (MO); St. Louis Co., Clayton, Waugh 10 June 1893 (MO); Shannon Co., Montier, Bush 6121 (MO).

ARKANSAS: Benton Co., 9 miles ne. of Springdale, Moore 350339 (UARK); TYPE of S. campestris f. albiflora Moore; Bradley Co., Warren, Demaree 19268 (MO, NY, OKLA); Conway Co., north edge of Morrilton, Edwards 28 June 1937 (PENN); Crawford Co., Van Buren, Demaree 15308 (MO, OKL); Dallas Co., Fordyce, Demaree 23341 (MO, OKLA); Faulkner Co., Conway, Morrison 2082 (US); Garland Co., in Hot Springs National Park, Gregg 47 (UARK); Miller Co., Texarkana, Eggert 9 June 1898 (MO, NY); Nevada Co., 4 miles

southeast of Prescott, Hollister 36 (US); Pulaski Co., Little Rock, Merrill 93 (UARK); Saline Co., Benton, Palmer 8132 (MO, MT, NY, US); Sebastian Co., Fort Smith, Bigelow 1853--54 (NY, US); Sevier Co., Little River-Horatio, Brinkley 344 (F, TEX); Washington Co., ne. of Fayetteville, Buchholz 15 July 1923 (NY, UARK).

LOUISIANA: Acadia Parish, Crowley, Pennell 10199 (NY); Calcasieu Parish, vicinity of Lake Charles, Allison 279 (NY, US); Morehouse Parish, Mer Rouge, Brown 6515 (GH); Natchitoches Parish, near Chestnut, Dorman 20 June 1930 (NY); Orleans Parish, New Orleans, Drummond 223 (GH, K); Rapides Parish, southwest of Woodworth, Hedgcock 1 June 1938 mixed sheets (DUKE, NA, TEX); St. Tammany Parish, St. Tammany, Langlois 1 Apr. 1893 (US); Tangipahoa Parish, east of Hammond, Brown 6342 (GH); Washington Parish, Bogalusa, Kraus 30 June 1925 mixed sheets (MT, WIS); Winn Parish, 10 miles west of Winnfield, Webster & Wilbur 3261 (MICH).

KANSAS: Bourbon Co., 4 mi. w. of Ft. Scott, Horr E165 (DUKE, FLAS, PENN, NCS, OKL, OKLA, SMU, US); Crawford Co., near McCune, Merritt 1935 (KSC); Cherokee Co., Baxter Springs, Oyster 5445 (F, MO, NY); Greenwood Co., Eureka, Hitchcock July 1892 (KSC); Labette Co., Parsons, Letterman, 10 July 1880 (F, MO, NY, US); Montgomery Co., 5 miles northeast of town, Rydberg & Imler 408 (KSC, MO, NY); Neosh Co., Thayer, Ewing 27 June 1891 (KSC, MO, NY, US).

OKLAHOMA: Bryan Co., 1 mile east of Denison Dam, Kelting 210 (OKL); Carter Co., Ardmore, Palmer 10403 (MO, US); Choctaw Co., 4 mi. e. of Ft. Towson, Rose 2 June 1941 (OKL, OKLA); Cleveland Co., Norman, Demaree 13112 (GH, MO, NY, OKL, US); Comanche Co., near Cache, Stevens 1328 (GH, MO, NY, OKL, OKLA, US); Cotton Co., 12.5 mi. e. and 1 s. of Randlett, Waterfall 7821 (OKL); Creek Co., 7 miles north of Sapulpa, Marion & Ruth Ownbey 1606 (GH, MICH, MO, NY, OKL, PENN, TEX, US); Garvin Co., north of Davis, Waterfall & Hennedy 2333 (GH); Garfield Co., 5 miles northeast of Breckinridge, Gephart 712 (OKL); Grady Co., eastern part of county, Smith 2028 (OKL); Johnston Co., near Mannsville, Griffith 3474 (GH, MO, NY); Kay Co., 1.5 mi. n. Nardin, Skirving 338 (OKLA); Kingfisher Co., west of Cashion, Grace 259 (MO, OKL); Latimer Co., 20 mi. e. of Wilburton, Kilgore 7 June 1937 (OKL, OKLA); Leflore Co., near Page, Blakley 1510 (GH, MO); Logan Co., near Guthrie, Stevens 3286 (GH); Love Co., south side of Lake Murray, McLennon 1 (OKL); McClain Co., north of Lindsay, Rohrbaugh 78 (OKL); McCurtain Co., 1 mi. e. of Idabell, Wehling 42 (OKLA); Marshall Co., Willis, Starks 8 July 1950 (OKL); Murray Co., 2 mi. n. and 1 mi. w. of Sulphur, Waterfall 6510 (GH, OKL); Muskogee Co., 4 mi. se. of Braggs, Waterfall 10074 (OKLA); Noble Co., 2 mi. se. of Perry, Harding 550 (OKL); Oklahoma Co., 3 miles west of La Bajahada, Waterfall 2799 (GH, OKL); Payne Co., 7 mi. e. and 2 s. of Stillwater, Miller 23 (GH); Pontotoc Co., Ada, Robbins 2602 (OKL); Pottawatomie Co., Tecumseh, Barclay 257 (OKL); Rogers Co.,

2.5 miles east of Chelsea, Jones 528 (GH, OKL); Tulsa Co., ne. of Tulsa, Waterfall 2316 (GH, OKL).

TEXAS: Anderson Co., Palestine, Palmer 14443 (MO); Arkansas Co., north of Rockport, Whitehouse 18241 (SMU); Atascosa Co., north of Charlotte, Schulz 4 May 1919 (US); Austin Co., Wallis, Pennell 10276 (NY); Bastrop Co., Bastrop-Buescher State Park, Lundell & Lundell 8999 (MICH); Bell Co., 3 miles north of Holland, Wolff 891 (US); Bexar Co., 10 miles east of San Antonio, Wilkinson 163 (MO); Bowie Co., n. Texarkana, Eggert 2 June 1898 (MO); Brazoria Co., Columbia, Bush 76 (GH, MO, NY, US); Brazos Co., Bryan, Palmer 11772 (MO, US); Burleson Co., 12 miles southwest of Caldwell, Cory 51649 (SMU); Burnet Co., Granite Mt., Tharp 688 (TEX, US); Caldwell Co., Luling, Bogusch 1322 (TEX); Calhoun Co., Port Lavaca, Tharp 22 May 1930 (DUKE, KSC, MO, MT, OKLA, TAES, TEX, WVA); Cameron Co., vicinity of Brownsville, Shiller 577 (US); Chambers Co., 5.75 miles s. of Anahuac, Parks & Cory 16 May 1937 (TAES); Childress Co., Childress, Biology Class 6 June 1931 (TEX); Colorado Co., Columbus, Rusby 11 June 1910 (NY); Cooke Co., near Tyler Bluff, Correll & Correll 12944 (NCS, SMU); Dallas Co., near Seagoville, Lundell & Lundell 9380 (MICH, SMU); Denton Co., 4.5 miles north of Grapevine, Whitehouse 16213 (SMU); DeWitt Co., western part of county, Riedel 18 Apr. 1942 (TEX); Dimmit Co., near Carrizo Springs, Palmer 33763 (NY); Erath Co., 7.5 miles west of Stephenville, Cory 39240 (GH); Falls Co.,

2 miles west of Rosebud, Wolff 965 (US); Fannin Co., 4 miles n. of Bonham, Shinners 7844 (SMU); Fayette Co., La Grange, Moebus 11 May 1935 (TEX); Freestone Co., 10 miles north of Teague, Harding 528 (MO, OKLA); Frio Co., near Moore, Palmer 33868 (GH, MO, NY, US); Galveston Co., Galveston, Bebb, 1155 (F, OKL); Gillespie Co., Squaw Creek, Jermy 505 (MO, US); Gonzales Co., Sefkey Swamp, Cory 5778 (GH); Grayson Co., about 1 mi. n. of Denison, Gentry 50-257 (FLAS); Gregg Co., without exact locality, York May 1939 (GH, MO); Grimes Co., Navasota, collector not stated May 1934 (TEX); Harris Co., Houston, Hall 508 (BRU, F, GH, NO, NY); Hays Co., San Marcos, Stanfield July 1897 (NY); Henderson Co., 12 miles west of Athens , Sanders 154 (MICH SMU); Hidalgo Co., near Pharr, McKelvey 1748 (GH, US); Hood Co., 5.25 miles south of Granbury, Shinners 11471 (GA, NCS, SMU); Hopkins Co., near Sulphur Springs, Totten (NCU); Houston Co., without definite locality, English 16 Apr. 1930 (TEX); Hunt Co., 10.5 miles northeast of Terrell, Cory 53288 (SMU); Jackson Co., Cordele, Drushel 9516 (MO); Jefferson Co., near Nome, Wright & Munz 22 June 1917 (CU); Jim Hogg Co., 25 miles w. of Falfurrias, Hamby 1065 (NA); Kaufman Co., 8 mi. e. of Kaufman, Hamby 1326 (NA); Kennedy Co., Sarita, Lewton 126 (US); Kerr Co., Kerrville, Reed 3288 (US); Kleberg Co., King's Ranch, Schulz 123 (US); Lee Co., 0.5 miles northeast of Lincoln, Cory 51672 (SMU); Liberty Co., Hightower, Lehman 17 June 1934 (GH, NY, TEX); Llano Co., Enchanted Rock, Tharp 11 June 1930 (GH, MO, NY,

SMU, TAES); McLennan Co., at Gaphead, Smith 573 (TEX, UARK); Mason Co., 15.5 miles east of Mason, Cory 37838 (GH, TAES); Matagorda Co., Midfields, Tharp 7 Apr. 1939 (MICH, NY, TEX); Medina Co., without exact locality, Tharp 24 June 1941 (TEX); Montague Co., 10.3 miles east of Ringgold, Whitehouse 10065 (SMU); Navarro Co., Corsicana, Bannister 23 (TEX); Nueces Co., Corpus Cristi, Orcutt 5952 (MO); Orange Co., 4 miles west of Orange, McVaugh 6872 (MICH, SMU); Palo Pinto Co., vicinity of Mineral Wells, Gillespie 5232 (US); Parker Co., Weatherford, Tracy 8045 (CU, F, GH, MO, NY, TEX, US); Refugio Co., 5.3 miles se. of Austwell, Cory 9 Apr. 1945 (GH, SMU); Robertson Co., between Franklin and Hearne, Barkley 13004 (MO, TEX, US); Rockwall Co., 30 miles east of Dallas, Webster & Wilbur 2960 (MICH); Rusk Co., 5.2 miles northwest of Tatum, Cory 56450 (SMU); Sabine Co., 7.3 miles south of Bronson, Cory 56553 (SMU); San Patricio Co., near Sinton, Wolcott & Barkley 16T1410 (TEX); Smith Co., Tyler, Cory 56345 (GA, SMU); Stephens Co., Ivan, Deaton 9 July 1931 (GH, MO, TEX); Tarrant Co., 2.3 miles northeast of Euless, Cory 53260 (SMU, US); Tom Green Co., Dove Creek, Tweedy 43 (US, YU); Travis Co., Austin, Tharp 16 May 1939 (MICH, MO, NA, NY, SMU, TEX); Trinity Co., 16 miles southwest of Trinity, Goodrum 2008 (TEX); Tyler Co., 6.2 miles north of Colmesneil, Cory 56735 (NCS, SMU); Uvalde Co., Uvalde, Milligan (US); Val Verde Co., Del Rio, Dewey 13 June 1891 (US); Van Zandt Co., 4.4 miles east of Wills Point, Cory 56328 (SMU); Walker Co., Huntsville, Tharp 44150 (TEX, WVA); Washington Co., without exact

locality, Brackett 21 May 1938 (TEX); Wichita Co., Wichita Falls, McKee 11 June 1926 (TEX); Willacy Co., Yturria Station, Runyon 1635 (US); Williamson Co., Georgetown, Brown 16 June 1941 (TAES); Wilson Co., Floresville, Cruz Sept. 1930 (TEX); Wise Co., 2 miles west of Decatur, McVaught 7198 (MICH, SMU); Wood Co., Mineola, Sanders 179 (MICH, SMU).

This species is easily recognized by its prominently ribbed calyx tube together with its thin membranous leaves.

The nomenclature of the species is not at all involved; but, as the Rafinesquian proposals have not been previously identified and prior to this were not relegated to synonymy, they merit discussion. Nuttall's type, or authentic material known to have been in his possession when the original description was made, has not been seen by me but his diagnosis is so ample as to leave no doubt as to the plant he had at hand. As yet only four species of the genus are known from Arkansas and of these Nuttall's excellent description fits but one. The original collection is stated to have been made "in the open prairies of Arkansas and Red River."

If one were to accept the date of publication that appeared with the works of Nuttall and Rafinesque describing this species, one would reach a conclusion other than that adopted here as to which name is the later synonym. It will be necessary, therefore, to discuss each publication date briefly. Nuttall's "Collections toward a Flora of the Territory of Arkansas" appeared in Vol. 5 of the

"Transactions of the American Philosophical Society." It has been dated as 1837, the year that that volume was apparently completed. Foster (Rhodora 46:156-157. 1944.) has pointed out, however, that that date is certainly later than the publication and distribution of Nuttall's portion. W. J. Hooker was familiar with Nuttall's account and cited it and descriptions provided in it on several occasions. The original diagnosis of S. campestris was quoted by Hooker (1836, p. 171) and its place of publication cited to the page. Since Sprague (Kew Bull. 1933: 362-364) has provided very precise dates for the publication of the various parts of Hooker's "Companion to the Botanical Magazine," it is certain that the whole of Nuttall's contribution, and not just the first twenty-one pages, as implied by Foster, was published and had reached England some time prior to the publication of Vol. 1, No. 6 of the Companion, which appeared January 1, 1836. The four volumes of Rafinesque's New Flora were issued, not in 1836 as stated on the title page, but at various dates between late 1836 and late 1838. This has been demonstrated by Barnhart (Torreya 7:177-181. 1907.) not only by internal evidence but also by reference to a series of letters sent by Rafinesque to Torrey which included many references to the progress in publication of his work. The names of Sabatia appeared in the part which appeared in 1838.

The Rafinesquian names here considered as synonymous with S. campestris were all published in one paragraph and were all meant for the same entity. His account is

quoted in full as it seems the surest way to convey conviction as to the identity of the plant described by him and also to explain his peculiar nomenclature.

> 975. Sabbatia ? nervosa Raf. ramose pauciflore, branches anceps, leaves ovate lanceolate trinerve acute, peduncles axil. and terminal, calix base campanulate 5 gone, segments linear elongate nervose, corolla as long as calix, segments broad obovate, trinerve at base -- anonymous sp. of Nuttal, which deserves perhaps to be a genus Neurola Raf. by calix 5 gone corolla nerved, stamens rolled up but not twisted, style declinate and with linear stigmas as in Sabbatia. From Arkansas, 8 inches high, leaves small remote semi-uncial, flowers large over uncial incarnate ? Neurola arkanzica will be a better name.

This description, which alone is rather convincing, coupled with the information that the specimen was one of Nuttall's collections from Arkansas leaves no doubt about the identity of the plant. Nuttall found only two species on that journey, S. campestris and the well-known S. angularis. Rafinesque (Aut. Bot. p. 55. 1840.) was still uncertain as to the proper rank to bestow upon this species for he referred to it as "Sabbatia nervosa or Neurola arkanzica...fine subg. perhaps a Genus..."

The final proposal of specific rank for this species was made by Buckley. The specimen upon which this was based has not been seen by me but again the description is such that determination is certain. The original publication reports it to have been collected in Llano Co., Texas, whence numerous specimens of S. campestris have been examined. That is the only species of the genus known from central Texas. Llano County is very close to the western limits of its range. Buckley's proposal was promptly

relegated to synonmy by Gray (Proc. Acad. Nat. Sci. Phil. 1862: 166, 1863.) whose regret as to the "hundred worse than useless synonyms" published with S. formosa, especially after the caustic criticism strongly reminiscent of an even later Fisher Professor of Natural History, was doubtless shared by Buckley.

Merrill (Rhodora 50:127. 1948.) equates S. concinna Wood with S. campestris rather than with S. brachiata to which Gray long before had reduced it and with which Wood himself considered it synonymous in his later works. The evidence that it is anything but S. brachiata is not convincing and the name is more fully discussed with the latter species.

7. Sabatia arenicola Greenm.

Sabbatia arenicola Greenman, Proc. Am. Acad. 34: 569. 1899.

Sabbatia carnosa Small, Fl. SE. U. S. 927. 1903.

Erect annual (3)10--20(32 or up to 45 in greenhouse-grown plants) cm. high; stems rigid, 1--3 mm. in diameter, succulent when young but becoming less so with maturity, more or less terete in the few lowermost internodes but becoming strongly quadrate above and the corners winged by a fine, hyaline membrane about 0.1--0.3 mm. high, barely discernable in dried material. Branches most commonly arising from near the base and then often opposite but becoming alternate above, or in more loosely developed plants absent from the lower half of the plant and alternate

throughout, strongly ascendent or at first widely divergent (up to 60 degrees) and, in plants grown under the normal highly exposed environmental conditions, typically presenting an almost globose form or a compact corymbiform to convex crown. Root system most commonly a strongly developed fibrous tap-root system or almost as commonly with several almost equally developed fibrous roots; these 4--20 cm. long and bearing few to several slender laterals. Leaves thick, widely spreading, strikingly succulent, shiny, leavily cutinized, venation almost completely obscured in living material, not at all elevated on either surface, appearing 3--5 nerved in dried specimens, the lowermost narrowly spatulate to somewhat elliptic, strongly tapering to the almost petiolate base, becoming above elliptical to ovate-lanceolate or rarely somewhat oblong, usually broadest one-fourth to one-third the length from the base or even near the middle, and somewhat tapering to the sessile non-clasping base, obtuse to acute with a minute, non-chlorophyllous callosity forming a mucronulate tip, (0.7)1.2--1.8(2.7) cm. long, (2.0)5.0--8.0(13.0) mm. wide, usually about 1.5--4 times as long as broad. Internodes (0.3)1.0--2.0(8.0) cm. long, usually 0.5--2 times the length of the leaves but in more loosely developed plants not uncommonly up to 4 or more times as long as the leaves. Inflorescence of corymbosely to pyramidally arranged cymules compactly clustered or borne loosely in plants grown under less rigorously exposed conditions. Cymules 1--2-flowered. Peduncles often somewhat succulent, rigid,

pentagonal, bearing 5 fine, hyaline, membranous wings, 0.5--3(7) cm. long. Calyx tube broadly campanulate to urceolate, usually about twice as long as broad, (0.3)1.0--2.0(8.0) mm. long, becoming broadly turbinate in fruit, strongly pentagonal due to thick, somewhat succulent costae, or ribs about 0.5--0.7 mm. high, the internal portion of which is chlorophyllous, the outer finely hyaline margined. Intercostal tube very thinly membranous, colorless but translucent, thus appearing green due to the ovary within. Calyx lobes thick, succulent, heavily cutinized, erect in bud but becoming strongly spreading at anthesis, (0.5)1--1.5(3) times longer than the tube, (0.3)0.5--1.2(2.0) cm. long, oblong to most commonly linear-lanceolate, usually about 3 times as long as broad, acute, minutely hyalinely callose-tipped, becoming prominently nerved when dried, very similar to leaves in texture. Corolla tube exceeding calyx tube as well as the ovary by about 1--2 mm., lower portion colorless, the upper colored by extension of the yellow patches at lobal bases. Corolla lobes more or less equalling or somewhat shorter than the calyx lobes, or rarely longer, ascendent to strongly spreading, broadly spatulate, obovate, or oblong, obtusely rounded, (0.5)0.7--1.0(1.3) cm. long, 3--7.5 mm. wide, deeply roseate or pure white, both forms with a 2--3 mm. long, 1.5 mm. wide, basal, oblong, yellow patch, which in rose-flowered forms often bordered by deeper shade of red. Anthers bright-yellow, oblong, 1.5--2 mm. long; filaments white to pale-yellow, slender, 2--4 mm. long. Style slender, colorless to pale greenish-yellow, 2--3.5 mm.

long; stigmatic branches green to greenish-yellow, 2.5--4 mm. long. Capsule 5--9 mm. long, equalling and included within the calyx tube or exserted by 1--3 mm.

Type locality: "on damp sands of seacoast near Tampico, State of Tamaulipas, Mexico." Type: Pringle 6808 (GH!).

DISTRIBUTION: Beaches and dunes from Louisiana southward to at least the southern part of the State of Tamaulipas, Mexico.

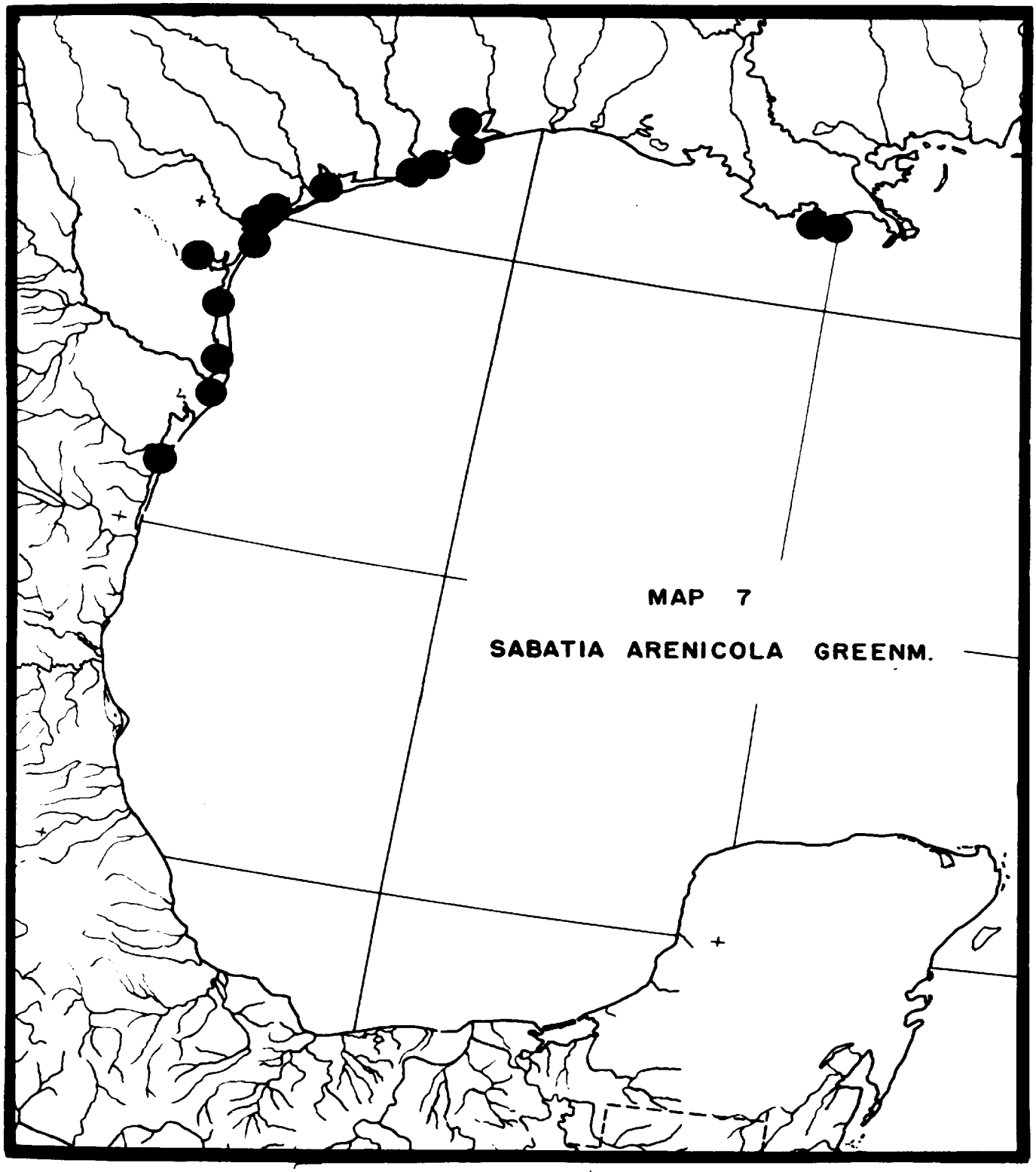
SPECIMENS EXAMINED.

LOUISIANA: Jefferson Parish, Grand Isle, Cangemi & Andrus 13 June 1931 (NY); Terrebonne Parish, Timbalier Island, Tharp 29 July 1929 (MO, TEX).

TEXAS: Aransas Co., north of Rockport, Whitehouse 18232 (SMU); Brazoria Co., Rio Brazos, Drummond 59 (GH, K, NY); Calhoun Co., beach near Port O'Connor, Webster & Wilbur 3134 (MICH); Cameron Co., beach at Brazos Santiago, Schott 27 (F, NY); about 3 miles west of Boca Chica, Lundell & Lundell 8635 (GH, MICH, NY, SMU); Galveston Co., beach on Galveston Island, Webster & Wilbur 3153 (MICH); Harris Co., Morgan's Point, Palmer 11966 (MO, US); Kennedy Co., El Toro Island, Tharp 49218 (TEX); Kleberg Co., Kingsville, Sinclair 1940 TEX); Matagorda Co., beach beyond Sargent, Webster & Wilbur 3152 (MICH); Nueces Co., north end of Padre Island, Webster & Wilbur 3092 (MICH); San Patricio Co., 10 miles south of Aransas Pass, Whitehouse 18213 (SMU).

MAP 7

Distribution of *Sabatia arenicola* Greenm.


MAP 7
SABATIA ARENICOLA GREENM.

MEXICO:

TAMAULIPAS: Washington Beach, Runyon 461 (GH, NY, US); San Jose, LaSueur 349 (TEX); vicinity of La Barra, 8 kilometers east of Tampico, Palmer 297 (F, GH, US); Tampico, Pringle 6808 (BRU, F, GH, NY, UC, US).

The pronounced succulence of this species is perhaps its most striking characteristic and that by which it is most readily distinguished from the closely related but perfectly distinct S. campestris.

Many of the differences notes between the two species of subsection Campestres are such that one might expect them to be merely response of a highly plastic organism to an environmental extreme. Succulence and diminution of the various organs and structures and the assumption of an almost globose, compact form are features that logically would be expected among the littoral members of a species of wide environmental variation. S. arenicola, found along the strand and dunes from Louisiana to Tampico in Mexico possesses such characteristics and accordingly suspicion is raised as to its status

The few specimens of S. campestris observed in the field in almost similar situations, although stunted or dwarfed, failed to show the peculiarities characteristic of the littoral species. Furthermore, herbarium specimens of plants that were undoubtedly S. campestris by their morphological characters were collected, according to their accompanying labels, from what was approximately the

environment of S. arenicola. In addition, numerous plants of S. arenicola grown in the greenhouse from seeds collected at various stations along the Texan coast retained the pronounced succulent nature so characteristic of the littoral species. The greenhouse-grown plants were larger, more elongate, and much more diffuse than the majority of specimens of S. arenicola seen by me either in the field or in the herbaria but are approached to some extent by those growing in nature in the more sheltered areas. The principal distinguishing characteristics mentioned in the key remain constant and the plants of the two species grown side by side are readily separable. Therefore the suspicion is groundless that the differences employed in recognizing these entities are nothing more than ecological modifications of the phenotypic expression of the same genus. The plants are differentiated by many striking characters, the majority of which are genetically rather than environmentally controlled.

There are two specimens in the herbarium of the New York Botanical Garden annotated by Small as his S. carnosa. These are the only representatives of the littoral species that were available to him at New York prior to 1903 when his Flora was published. None of the specimens on either of the sheets are as much as 3 dm. tall, the maximum height mentioned in the original description. It is possible, however, that these were the only material seen by him before publication; they were certainly the only two annotated by

him as that species and one of them should perhaps be chosen as the type of that name. The only collection of the two that matches the statement "often branched at the base" is that of A. Schott taken on the beach at Brazos Santiago near the mouth of the Rio Grande on the expedition led by Major Emory to survey the Mexican boundary. The other specimen annotated as S. carnosa by Small is one of Drummond's but no other information, other than that it was from Texas, is presented on the accompanying label. The great similarity in aspect and in state of preservation strongly suggests that it is a duplicate of these specimens seen at both the Gray Herbarium and Kew which bear Drummond's collection number "59" and which came from the "Rio Brassos" [Rio Brazos] Texas. The New York specimen may well be taken as the lectotype. These specimens, the basis of Small's S. carnosa (1903), can in no way be distinguished from Greenman's S. arenicola (1899). It is very likely that Small was not aware of Greenman's proposition before he reached his conclusions, or, if he did, he made no mention of it. The Mexican specimens from Tampico, the type locality of S. arenicola, are a perfect match for many of the plants from the various localities along the Texan or Louisianan coast. Since they cannot be distinguished, Small's name is here placed in synonymy.

This species and S. campestris are usually readily separable if the specimens are adequate. A few collections have been seen, however, that indicate that hybridization may be taking place between them in the region where they

come into contact. Careful observation in the field should do much toward settling this suspicion.

D. Subsection CAMPANULATAE Blake

Subsect. Campanulatae Blake, Rhodora 17:56. 1915.

Annuals or perennials with either slender tap root, several fibrous roots, or an erect, branched, perenniating caudex. Branches typically alternate. Corolla 5-parted, rose, pink, or white. Calyx not strongly costate, smooth or merely ribbed.

TYPE SPECIES: Sabatia campanulata (L.) Torr.

The species forming this subsection are not of uniform habit of growth as three of the species are annuals, while one, the type, is a perennial with a subterranean system unique in the genus. An alternate branching pattern is typical of all the species in the subsection and the overall appearance of the plants is such that segregation appears inadvisable at least for the present. Admittedly the arrangement accepted here is not completely satisfactory since no strong and constant feature or even combination of features which distinguish this subsection can be pointed out. Yet the naturalness of the Campanulatae as interpreted here seems at least better founded than previously. For the time being, this arrangement will have to suffice.

KEY TO THE SPECIES

A. Caespitose perennial from branched erect caudex; calyx lobes usually more or less equalling the

corolla in length. . . . . 8. S. campanulata

A. Annuals with either a tap root or several fibrous roots; calyx lobes usually less than three-fourths the length of the corolla.

B. Calyx lobes linear to almost filiform, usually more than 8 mm. long; corolla usually pink or rose, rarely white; style 2 mm. or more in length; branches usually not numerous, mostly restricted to the upper half of the stem; nodes along the main axis not numerous, usually less than 15; root system typically of several, almost equal, fibrous roots.

C. Leaves drying thin and smooth, the uppermost equalling or exceeding the stem in diameter; corolla lobes usually less than 1.5 cm. long; calyx tube usually turbinate or narrowly campanulate. Known from Mexico, Cuba, the Bahamas, Florida west to Louisiana and north to southern Massachusetts, especially bordering salt marshes and littoral habitats. . . . . 9. S. stellaris.

C. Leaves drying thick and very noticeably rugose; above typically less than the stem in diameter; corolla

lobes usually longer than 1.5 cm.;
calyx tube usually broadly campanulate.
Known only from Cuba and peninsular
Florida. . . . . 10. S. grandiflora

B. Calyx lobes setaceous or subulate, less than 8 mm. long; corolla white; style 1 mm. long or less; branches usually numerous and typically arising from throughout the length of the stem; nodes very numerous and typically more than 20 along the main axis; root system of one prominently developed fibrous tap root with several slender laterals . . . . . 11. S. brevifolia

8. Sabatia campanulata (L.) Torr.

Chironia campanulata L., Sp. Pl. 1: 190. 1753.

Chironia gracilis Michx., Fl. Bor.-Am. 1: 146. 1803.

Chironia campanulata β gracilis (Michx.) Pers., Syn. Pl. 1: 282. 1805.

Sabbatia gracilis (Michx.) Salisb., Parad. Lond. t. 32. 1806.

Sabbatia campanulata (L.) Torr. Fl. N. & Mid. U.S. 217. 1824.

Sabatia campanulata f. albina Fern., Rhodora 18: 151. 1916.

Sabbatia Tracyi Gandoger, Bull. Soc. Bot., Fr. 65:61. 1918.

Sabatia campanulata var. gracilis (Michx.) Fern., Rhodora 39: 444. 1937.

Caespitose perennial from an erect, shortly much-

branched, underground caudex 1--4 cm. long. Stems few to numerous, erect, (15)30--60(90) cm. high, 1--3 mm. in diameter, terete but often strongly ridge-angled from fine elevated internodal lines, becoming hollow below. Branches typically alternate throughout, or occasionally those at lower nodes opposite, rarely opposite even above; usually restricted to the upper half of the stem but arising from throughout the length, strongly divergent forming an angle with the stem of 50--80 degrees or, especially in the northern portion of its range, strongly ascendent forming angle of about 20--40 degrees; few to numerous, slender, bearing but few nodes (more common in the northern portion of the range) or several. Root system of few to many, slender, but apparently succulent, roots arising from the caudex, about 5--10 cm. long by 1 mm. thick bearing few to several, very slender, fibrous laterals. Leaves ascendent to very commonly (especially the upper) strongly spreading, midvein noticeably elevated beneath, venation otherwise obscure, margins somewhat thickened and slightly revolute, drying thick, somewhat chartaceous, smooth or slightly rugose, obtuse to acute, broadly sessile or somewhat tapering in the broader leaves to the base. The lowermost leaves rarely ovate; the lower cauline (1)1.5--3(4) cm. long, (1)2--7(12) mm. wide, usually 5--12 times as long as broad, narrowly lanceolate, oblong, or linear gradually reduced above to very narrowly linear or even filiform; those of the branches very narrowly linear to even filiform. Internodes usually 1--2 times the length of the leaves. Flowers

apparently solitary, borne on alternate, rarely opposite, ascendent to widely divergent, slender branches bearing 1 to several nodes, or in more obvious cymules which are obviously reduced. Pedicels or peduncles (2)4--7(9) c. long, slender, wiry, slightly angled. Calyx tube shallowly turbinate or more rarely somewhat campanulate, smooth or nearly so, not nerved, scarious, usually about as broad as long, (1)1.5--2.5(3) mm. long. Calyx lobes linear to very narrowly so or very commonly acicular or setaceous, erect to more commonly widely spreading, (6)7--17(23) mm. long, typically less than 0.5 mm wide, but occasionally as wide as 1 or even 2 mm., usually 5--15 times as long as the calyx tube, generally nearly equalling the corolla in length, or but several millimeters shorter, rarely exceeding it. Corolla tube cylindrical, about 2--3 times as long as the calyx tube or exceeding it about 2--3 mm., colorless to white or pale greenish-yellow, (2)3--5(6) mm. long. Corolla lobes wide-spreading, oblanceolate, oblong, or elliptic, acute to obtuse, (0.6)0.9--1.8(2.4) cm. long, (3)4--7(9) mm. wide, usually about 2--4 times as long as wide, rose, pink or rarely white with an usually unlobed yellow area at base of lobe 2--3 mm. long, often bordered by a dull-red irregular line. Anthers slender, bright-yellow, (2)3--4(5) mm. long; filaments pale-yellow, slender, 2--4 mm. long, usually shorter than the anthers. Style 2--5 mm. long, usually shorter than its branches, green to greenish-yellow; stigmatic lobes 3--7 mm. long, pale-green turning yellowish (from pollen?) at maturity. Ovary pale-green, slightly

exserted from the corolla tube. Capsule cylindrical, 5--7 mm. long, 2.5--4 mm. in diameter, usually 1.5--2 times as long as wide.

Type locality: "in Canada." This plant is not known from farther north than Massachusetts. Type: Kalm (Photograph of the Type in the Linnean Herbarium seen from Gray Herbarium).

DISTRIBUTION: Peaty bogs and savannas from Massachusetts south to northern Florida and westward to Illinois and Louisiana.

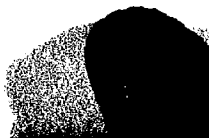
SPECIMENS EXAMINED:

MASSACHUSETTS: Barnstable Co., Barnstable, Fernald & Svenson Pl. Ex. Gr. 479 (CU, DUKE, F, GA, GH, MICH, MO, MT, NCS, NO, NY, OKL, PENN, SMU, TENN, TEX, UARK, US, WIS, WVA); Nantucket Co., Almanac Pond, Williams 30 July 1911 (GH); Plymouth Co., Pembroke, Foster (GH).

NEW YORK: Nassau Co., East Rockaway, Bicknell 7089 (NY); Suffolk Co., Oakdale, Ferguson 7775 (NY).

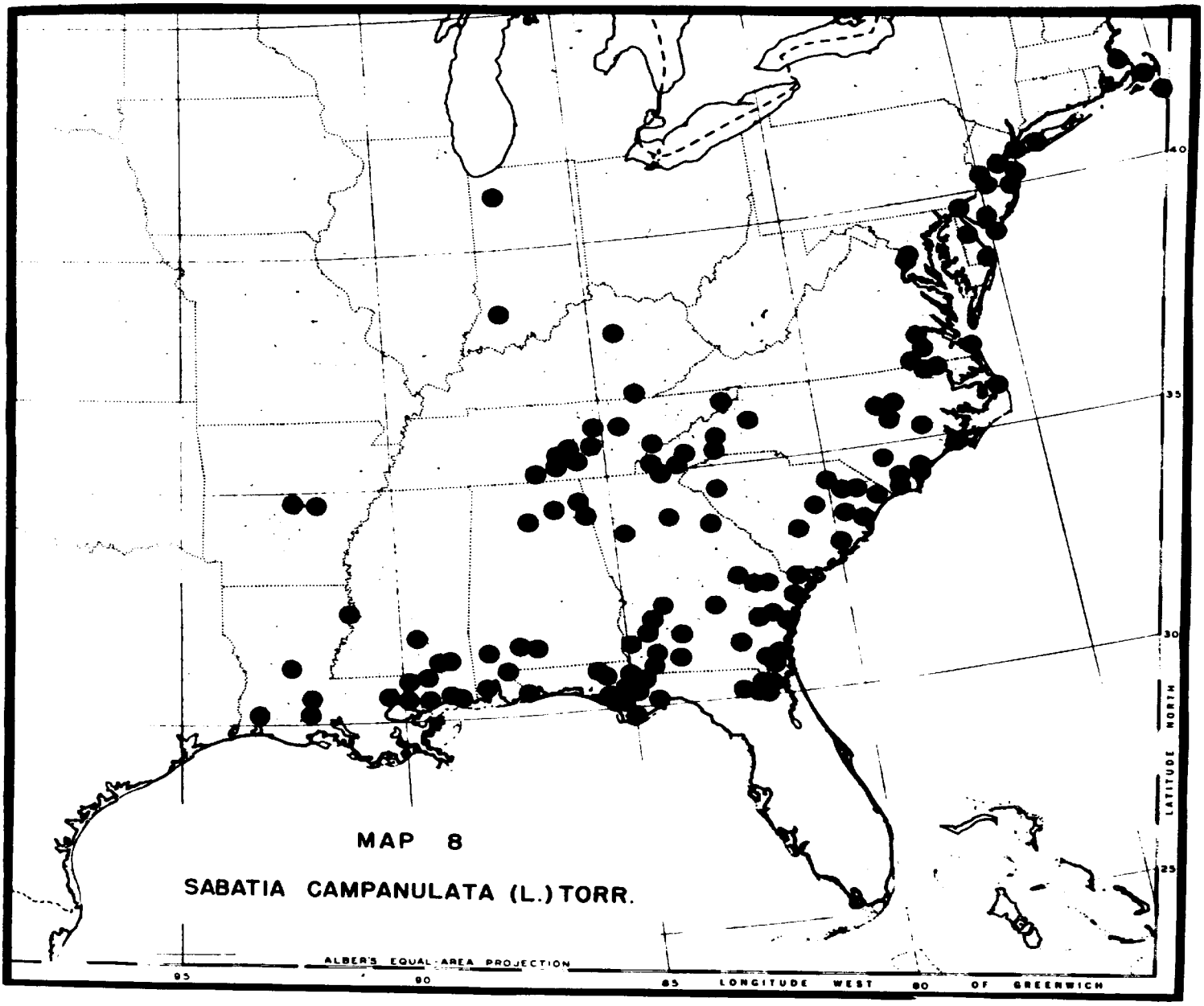
NEW JERSEY: Burlington Co., Burlington, Cooley (GH, YU); Cape May Co., west of Cape May City, Stone 19 July 1917 (GH); Cumberland Co., Vineland, Ellis, 29 July 1872 (WIS); Middlesex Co., near Raitan, Kelley 1 Oct. 1926 (MT); Monmouth Co., Belmar, Gershoy 570 (CU, GH); Ocean Co., e. of Silverton, Fogg 4908 (GH, NY, PENN, TENN).

PENNSYLVANIA: Bucks Co., Tullytown, MacElwee 28 July 1894 (GH, NY).



MAP 8

Distribution of Sabatia campanulata (L.) Torr.



MAP 8

SABATIA CAMPANULATA (L.) TORR.

DELAWARE: Kent Co., Felton, Canby July 1878 (US); New Castle Co., Wilmington, Canby 15 June 1876 (MO); Sussex Co., Bethany Beach, Freeman 24 July 1938 (NA).

MARYLAND: County unknown, Delaware Beach, Hood 2370 (FLAS).

DISTRICT OF COLUMBIA: Virginia Highlands, Griggs 17 July 1923 (US).

VIRGINIA: Fairfax Co., near New Alexandria, Muenscher 3825 (CU, MO); Greensville Co., north of Gaskins, Fernald & Long 13421 (GH, MO, TENN, US); Prince George Co., southeast of Petersburg, Fernald & Long 6350 (GH); Princess Anne Co., south of Rudy Inlet, Fernald & Long 4133 (GH, PENN); Sussex Co., about 4 miles northwest of Homesville, Fernald & Long 6351 (GH, NY, PENN).

NORTH CAROLINA: Bladen Co., White Oak, Fox & Godfrey 2649 (FLAS, GA, NCS); Brunswick Co., about 3 miles southeast of Ash, Wilbur 2891 (MICH); Buncombe Co., Black Mt., Todsen 8-6-39 (FLAS); Caldwell Co., 2 mi. w. of Lenoir, Anderson 4408 (DUKE); Carteret Co., between Newport and Cherry Point, Blomquist 13940 (DUKE); Cherokee Co., Andrews, Huger, Sept. 1900 (NY); Columbus Co., 2 miles west of Freeman, Wilbur 2882 (MICH); Dare Co., 2 miles south of Manteo, Radford 4638 (NCU); Henderson Co., 1 mi. s. of East Flat Rock, Oosting 1790 (DUKE); Hartford Co., e. of Como, Fox & Godfrey 2804 (NCS); Jackson Co., Cullowhee,

Thaxter 1887 (GH, US); Johnston Co., Smithfield, Blomquist 7 Sept. 1930 (GH); Lenoir Co., Kinston, Biltmore Herb. 4510k (NY, US); Macon Co., Highlands, Coker & Harbison 28 Aug. 1932 (NCU); Nash Co., Middlesex, Godfrey 5425 (GH, US); New Hanover Co., Wilmington, McCarthy 10 July 1885 (MO); Northampton Co., near Margarettsville, Heller 1160 (CU, F, GH, KSC, MO, MT, NY, PENN, US); Pender Co., just across the NE. Cape Fear River on Rt. 117, Wilbur 2896 (MICH); Wake Co., Raleigh, Burlingame Aug. 1886 (BRU).

SOUTH CAROLINA: Anderson Co., Belton, Smith 23 July 1881 (GH, US); Berkeley Co., Hellhole Bay, Martin 1st. Dist. SE Plants 54 (NA, NY, TENN, WVA, US); Darlington Co., west of Hartsville, Smith 1083 (NCU); Florence Co., Florence, Canby 3 July 1878 (F); Georgetown Co., 12 miles north of Georgetown, Godfrey & Tryon 66 (DUKE, F, GH, MICH, NY, PENN, TENN, US); Horry Co., without exact locality, Tarbox 639 (NA); Jasper Co., near Okeetee, Correll 5408 (GA, NA, TEX); Marion Co., 3 miles west of Marion, Wiegand & Manning 2546 (CU, GH); Orangeburg Co., Branchville, Biltmore Herb. 4510h (US); Sumter Co., without exact locality, Smith 4 Aug. 1884 (US); Williamsburg Co., 1 mile south of Kingstree, Wiegand & Manning 2547 (CU, GH).

GEORGIA: Baker Co., southeast corner of county, Thorne 4899 (CU); Barrow Co., Winder, Biltmore Herb. 4510 (US); Bartow Co., 4.5 miles s. of Allatoona Dam, Duncan 8521 (FLAS, GA, MO, SMU, TENN, US); Bullock Co., Big Lott's Creek, Harper 963 (GH, MO, NY, US); Calhoun Co.,

1.5 miles east of Cordray's Pond, Thorne 4671 (CU, GA); Camden Co., near Waverly, Correll 5510 (DUKE, GA, NA, NCS); Candler Co., 10 miles ne. of Metter, Pyron & McVaugh 739 (GA); Charlton Co., St. Mary's River at Cedar Landing, Harper 344 (GA, GH, NY); Chatham Co., near Savannah, Freeman 29 May 1925 (DUKE, NA); Decatur Co., about 4 miles west of Whigham, Wise 29 June 1940 (FLAS); Douglas Co., 2 mi. e. of Villa Rica, Cronquist 5418 (GA, GH, NO, SMU, US); Early Co., Big cypress area, Ford & Thorne 29 Aug. 1948 (TENN); Emanuel Co., e. of Swainsboro, Duncan 2681 (MICH); Long Co., 3 miles southwest of Ludowici, Wilbur & Webster 2757 (MICH); McIntosh Co., Darien Jct., Smith 2218 (MO, WIS); Miller Co., just n. of Donalsonville, Duncan 6750 (GA); Sumter Co., without exact locality, Harper 20 July 1897 (GH, NY); Telfair Co., McRae, Biltmore Herb. 4510j (US); Terrell Co., southwest of Smithville, Thorne & Muenscher 8401 (CU); Thomas Co., about 1 mile n. of Coolidge, Duncan 8466 (FLAS, GA, MO, TENN); Towns Co., Young Harris, Howell 389 (US); Ware Co., Hopkins to Waycross, Wright 877 (CU); Wayne Co., 2 miles nw. of Odum, Duncan 9714 (MICH); Wilkes Co., near Washington, Chapman (NY); Worth Co., vicinity of Poulan, Pollard & Maxon 583 (US).

FLORIDA: Baker Co., 4 miles s. of Macclenny, West & Arnold 12 July 1946 (FLAS); Bay Co., 1 mile north of Lynn Haven, Webster & Wilbur 3624 (MICH); Bradford Co., near Lawtey, Murrill 528 (DUKE, MO, US); Calhoun Co., Clarksville, West 21 July 1949 (FLAS); Columbia Co., east

of Lake City, Small, Small & DeWinkeler 11370 (NY, TENN); Duval Co., w. of Maxville, Murrill 573 (US); Escambia Co., Pensacola, Curtiss 1885 (NY); Franklin Co., Apalachicola, Chapman (MO); Gadsen Co., west of Quincy, Foster 65 (FLAS); Gulf Co., Wewahitchka, Biltmore Herb. Dist. Chapman Herb. 4510a (GH, NY, US); Holmes Co., Bonifay, Curtiss 6481 (GH, MO, NY, SMU, US); Jackson Co., near Sneads, Hood 2772 (FLAS); Liberty Co., near Bristol, West & Arnold 23 July 1940 (FLAS); Nassau Co., 1.5 miles south of Callahan, Wright 873 (CU); Union Co., n. of Raiford, Murrill 6-2-40 (FLAS); Wakulla Co., 3.5 miles s. of Sopchoppy, Webster & Wilbur 3630 (MICH); Washington Co., 8 miles south of Chipley, Webster & Wilbur 3615 (MICH).

INDIANA: Daviess Co., about 4 miles north of Washington, Deam 52742 (F, GH, MO, NY); Jasper Co., about 3 miles southeast of Wheatfield, Ek 30 July 1940 (GH).

KENTUCKY: Fayette Co., Lexington, Short 1831 (NY); Whitley Co., n. Jellico, Braun 21 July 1933 (GH, NY).

TENNESSEE: Bledsoe Co., beyond Mt. Crest near Van Buren County line, Underwood & Sharp 4040 (GA, TENN); Blount Co., in Cades Cove, Meyers and Iltis 2482 (TENN); Carter Co., 3. of Elizabethtown, Fairchild, Hernandes, Clebsch & Sharp 11777 (TENN); Coffee Co., n. of Manchester, Svenson 9219 (DUKE, CH, MO, NA, NY, WIS, US); Cumberland Co., Mayland, Jennison 12 July 1930 (GH); Franklin Co., near Tullahoma, Sharp, Clebsch & Fairchild 9938 (DUKE, GA,

NCU, OKLA, SMU, TENN, TEX, US); Grundy Co., between Tracy City and Coalmont, Svenson 9565 (GH, TENN); Lincoln Co., without exact locality, Biltmore Herb. 4510f (US); Morgan Co., Oakdale, Ferriss Aug. 1900 (MO); Warren Co., 1 mile ne. of Morrison, Shanks, Clebsch & Sharp 2848 (TENN).

ALABAMA: Baldwin Co., just southwest of Perdido, Webster & Wilbur 3516 (MICH); Cherokee Co., along Little River in May's Gulf, Harper 3995 (US); Conecuh Co., about 9 miles west of Evergreen, Webster & Wilbur 3514 (MICH); Cullman Co., Cullman, Mohr 20 Aug. 1886 (US); DeKalb Co., near Valley Head, Biltmore Herb. 4510g (US); Marshall Co., without exact locality, Biltmore Herb. 4510d (US); Mobile Co., about 8 miles southwest of Mobile, Webster & Wilbur 3480 (MICH); Monroe Co., Monroeville, Blanton 11 July 1933. (GH); Washington Co., 2.5 miles south of McIntosh, Webster & Wilbur 3493 (MICH).

MISSISSIPPI: Covington Co., 1.5 miles southeast of Mt. Olive, Webster & Wilbur 3336 (MICH); Forest Co., 18 miles nw. of Beaumont, Webster & Wilbur 3424 (MICH); Hancock Co., without exact locality, Woodson & Scherry 61 (MO); Harrison Co., about 7 miles north of Biloxi, Webster & Wilbur 3452 (MICH); Jackson Co., Ocean Springs, Pollard 1010 (CU, F, GH, MO, NY, US); Pearl River Co., 6 mi. n. of Poplarville, Langman 1936 (PENN); Perry Co., 9 miles north of Beaumont, Webster & Wilbur 3415 (MICH).

ARKANSAS: Lonoke Co., Grand Prairie, Demaree 22329 (MO); Pulaski Co., Little Rock, Harvey July 1882 (UARK).

LOUISIANA: Calcasieu Parish, Lake Charles, Cocks Sept. 1906 (NO); Lafayette Parish, Debaillon, collector not stated (NY); Madison Parish, near Tallulah, Muenscher & Winne 16781 (CU); Rapides Parish, Alexandria, Hale (GH); St. Landry Parish, Opelousas, Curtiss (GH); St. Tammany Parish, 1 mile north of Abita Springs, Pennell 4156 (NY, PENN); Tangipahoa Parish, 3 miles east of Robert, Correll & Correll 9307 (DUKE, MO, TEX); Washington Parish, Bogalusa, Kraus 30 June 1925 mixed sheets (MT, WIS).

Fernald recognized two populations within this species. The supposed differences as defined by him are presented below in tabular form.

campanulata	gracilis
1. Primary cauline leave oblong-linear to lanceolate.	1. Lower cauline leaves linear, the upper ones very narrowly so.
2. Pedicels naked or only slightly bracted.	2. Pedicels mostly leafy-bracted.
3. The linear calyx segments (except in small secondary flowers) 1--2 cm. long.	3. The linear-acicular calyx segments 6--14 mm. long.
4. The corolla segments 1--1.7 cm. long.	4. The corolla-segments 6--14 mm. long.
5. Branches erect or strongly ascendent.	5. Branches more divergent.
6. Upland and Piedmont region, Ga., and Ala., n. to Va., and Ind., and or near Coastal Plain to se. Mass.	6. On the Coastal Plain from Florida to Louisiana and se. Va.

Many of the specimens studied could be assigned to one or the other group with a fair degree of assurance by applying these criteria. Yet there are a number of puzzling collections which arouse a strong suspicion as to one's

ability to determine "correctly" a large series of specimens from unspecified localities. For example, Deam (1940) considered the material from southwestern Indiana to be a representative of the population typical of the Coastal Plain, but Fernald (1950) mentioned Indiana only in the range of S. campanulata.

Fernald (Rhodora 34:27) originally had considered the plants found along the southern Coastal Plain to be "a rather well defined species" although he admitted that "...it may be better to treat it as a southern Coastal Plain variety...." After encountering specimens in southeastern Virginia that possessed some of the distinguishing characteristics of both varieties, Fernald (Rhodora 39:443-444. 1937) concluded that "...S. gracilis should be treated as a geographical variety." Those disconcerting specimens combined the narrow leaves and calyx segments presumably characteristic of the southern Coastal Plain population with the longer lobes of both calyx and corolla of the more northern collections. Since numerous large-flowered specimens had been observed throughout the supposed range of S. gracilis, several hundred measurements were tallied for comparison and are presented below. The specimens from southeastern Virginia which Fernald considered atypical as they showed features of both populations were not included in the following tables.

These hundreds of measurements indicate that, although the smallest flowers were found on the specimens from the range of S. gracilis and the largest from the

TABLE 1

Length of Calyx Lobes

mm.	No. of lobes *gracilis* range	No. of lobes *campanulata* range
6	6	0
7	23	5
8	30	6
9	42	18
10	40	22
11	50	31
12	60	42
13	45	36
14	45	20
15	27	19
16	19	11
17	10	19
18	7	9
19	1	5
20	4	2
21	2	1
22	0	1
23	0	1

TABLE 2

Length of Corolla Lobes

mm.	No. of lobes *gracilis* range	No. of lobes *campanulata* range
6	1	0
7	4	0
8	4	1
9	16	7
10	34	16
11	44	38
12	63	38
13	52	43
14	36	38
15	32	19
16	17	7
17	15	0
18	10	0
19	4	2
20	2	0
21	0	1
22	0	0
23	0	0
24	0	1

range of the more northerly population, no reliance can be placed upon the length of either the calyx or corolla segments as a distinguishing characteristic between the two supposed varieties. This large series of measurements shows that the range of the flower size of the plants from the Coastal Plain is considerably greater than that known to Fernald and for diagnostic purposes the range of the length of the lobes of either floral series is so broadly overlapping as to be unworkable.

Nor am I able to detect any consistent differences in the shape of the calyx lobes between those specimens of the Coastal Plain south of Virginia and those from the Appalachian region and the Coastal Plain north of Virginia. Numerous specimens from Florida and the other states of the supposed range of S. gracilis have linear calyx lobes presumably characteristic of the northern variety.

By "pedicels" Fernald apparently meant lateral branches bearing flowers. These branches in the Massachusetts material, with which Fernald had field experience, are typically short and rather strongly ascendent and their one or two nodes bear bracts that are foliose in comparison to the narrowly linear to even filiform bracts of the typical southern coastal material. A tendency for opposite branching in the upper part of the stem is also more pronounced, especially in more robust specimens, and then the unreduced cymose pattern of inflorescence is somewhat more apparent. These rather striking characteristics found with considerable constancy in the few New England stations

are far less apparent in the specimens seen from the more southern part of the range of the supposed typical variety. Numerous specimens from the mountainous regions of Georgia, Alabama, the Carolinas, Tennessee and Kentucky, as well as Deam's Indiana station possess elongate, widely divergent branches with several to numerous nodes bearing narrowly linear to even filiform bracts. The extremes of leaf type from the two ranges are often most striking and clear-cut but many specimens within the range attributed to one of the varieties would be assigned to the other upon the application of this criterion. These considerations have convinced me that it would be unwise to attempt dividing this species in spite of some rather strong tendencies which are somewhat geographically segregated and whose extremes are of rather striking difference. Too many specimens from the range of one of the supposedly distinct populations would be assigned on morphological grounds to the other variety.

Gandoger published the description of S. tracyi basing it upon the specimen in his herbarium of Tracy 6468 collected at Biloxi, Mississippi. I have not seen the type but four specimens of the same number are located at the Gray Herbarium (2 sheets), New York Botanical Garden, and the National Herbarium. They are most certainly isotypes. Gandoger described his specimen as an annual and this would relate or equate S. tracyi with S. stellaris, the only annual of subsection Campanulatae known to the state. The presumed isotypes are perennials with narrowly

oblong-linear to linear leaves gradually reduced above and on the branches to filiform bracts; their branches, which are alternate, are elongate, bear numerous nodes, and are very strongly divergent. There is still a trace of rose-pink color on the corolla lobes of at least three of the sheets seen although even on those sheets most of the flowers appear yellowish-white. Gandoger's species was described as having white flowers which together with the more slender leaves and mucronate sepals distinguished it from S. gracilis. S. tracyi is synonymous with S. campanulata, or, if one prefers to recognize what seems to me to be a variation too weak to maintain, with S. campanulata var. gracilis (Michx.) Fern. It may be matched by a majority of the specimens collected along the Gulf and Southern Atlantic Coastal Plain.

9. Sabatia stellaris Pursh.

Chironia amoena Raf., Med. Repos. II. 5: 359. 1808.
not Salisb., Prodr. 137. 1796.

Sabbatia stellaris Pursh, Fl. Am. Sept. 1: 137. 1814.

Chironia stellata Muhl., Cat. Pl. Am. Sept. ed. 2, 23. 1818.

Chironia stellaris (Pursh) Eaton, Man. ed. 2, 204. 1818.

Sabbatia maritima Raf., Med. Fl. 2: 77. 1830.

Sabbatia amoena (Raf.) G. Don, Gen. Hist. 4: 207. 1838.

Sabbatia stellaris β pumila A. Gray ex Griseb., Prodr. 9: 49. 1845.

Eustoma maculata Benth., Pl. Hartw. 292. 1848.

Sabbatia gracilis β stellaris Pursh Wood, Am. Bot. & Flor. 267. 1870, without basic synonym.

Sabbatia nana Featherman, Rep. Bot. Surv. S. & Cent. La. 71. 1871.

Sabbatia maculata (Benth.) Benth. ex. A. Gray, Proc. Am. Acad. 22: 438. 1887.

Sabbatia Palmeri A. Gray, Proc. Am. Acad. 22: 438. 1887.

Sabbatia stellaris f. albiflora Britton, Bull. Torrey Club 17: 125. 1890.

Sabbatia simulata Britton, Bull. N. Y. Bot. Gard. 3: 448. 1905.

Sabbatia Purpusii Brandegee, Univ. Calif. Pub. Bot. 4: 275. 1912.

Sabatia amoena f. albiflora (Britton) Fern., Rhodora 34: 26. 1932.

Sabbatia campanulata var. amoena (Raf.) Monachino, Torreya 41: 99. 1941.

Erect annual (2)15--50(80) cm. high; stem 1--4 mm. in diameter, terete to strongly angled due to several somewhat irregularly disposed fine lines or ridges extending between nodes, pith parenchymatous in young living specimens but becoming hollow in older or dried specimens. Branches almost always alternate, very rarely one or so nodes with opposite branches, usually restricted to upper half or two-thirds of the stem but often arising throughout the length and even from the base, typically strongly divergent, forming an angle of about 30--70(85) degrees with the stem, few to numerous, slender, wiry, bearing few to numerous nodes.

Root system of several to numerous, usually slender, but occasionally thickened, fibrous roots 2--10 cm. long, 1--3 mm. in diameter or occasionally with one principal root and several laterals. Leaves ascendent, above often closely appressed to stem, succulent, thick, rubbery in texture, midvein conspicuous and elevated beneath, venation otherwise obscure; after drying leaves commonly darken, usually thinly membranous or occasionally the lowermost slightly rugose, the midvein alone usually prominent. Lower leaves broadly to narrowly elliptic, or even linear, rarely spatulate or obovate, acute to rarely obtuse, often apiculate, usually tapering to both ends, typically about 5--10 times as long as broad, (0.5)1.5--3(6) cm. long, (2)3--8(15) mm. wide, the upper more narrowly elliptic to linear, the uppermost sometimes very narrowly so to even almost filiform, usually 7--15(20) times as long as wide, 1--4 cm. long, (0.5)1.5--3(5) mm. wide, typically exceeding the diameter of the stem or at least equalling it. Internodes usually 1--2 times the length of the leaves. Flowers appearing solitary but usually arranged in very loose and reduced cymules and these sometimes aggregated in loose dichasia. Flowers borne on slender, straight, ascendent to divergent pedicels (1)4--10(15) cm. long, usually about 0.5 mm. in diameter. Calyx-tube turbinate, or occasionally even narrowly campanulate, usually rather gradually narrowing to the base, smooth or but very faintly nerved, thin, somewhat scarious, usually 1--2 times as long as broad, (1.5)2--4(6) mm. long. Calyx lobes narrowly linear to



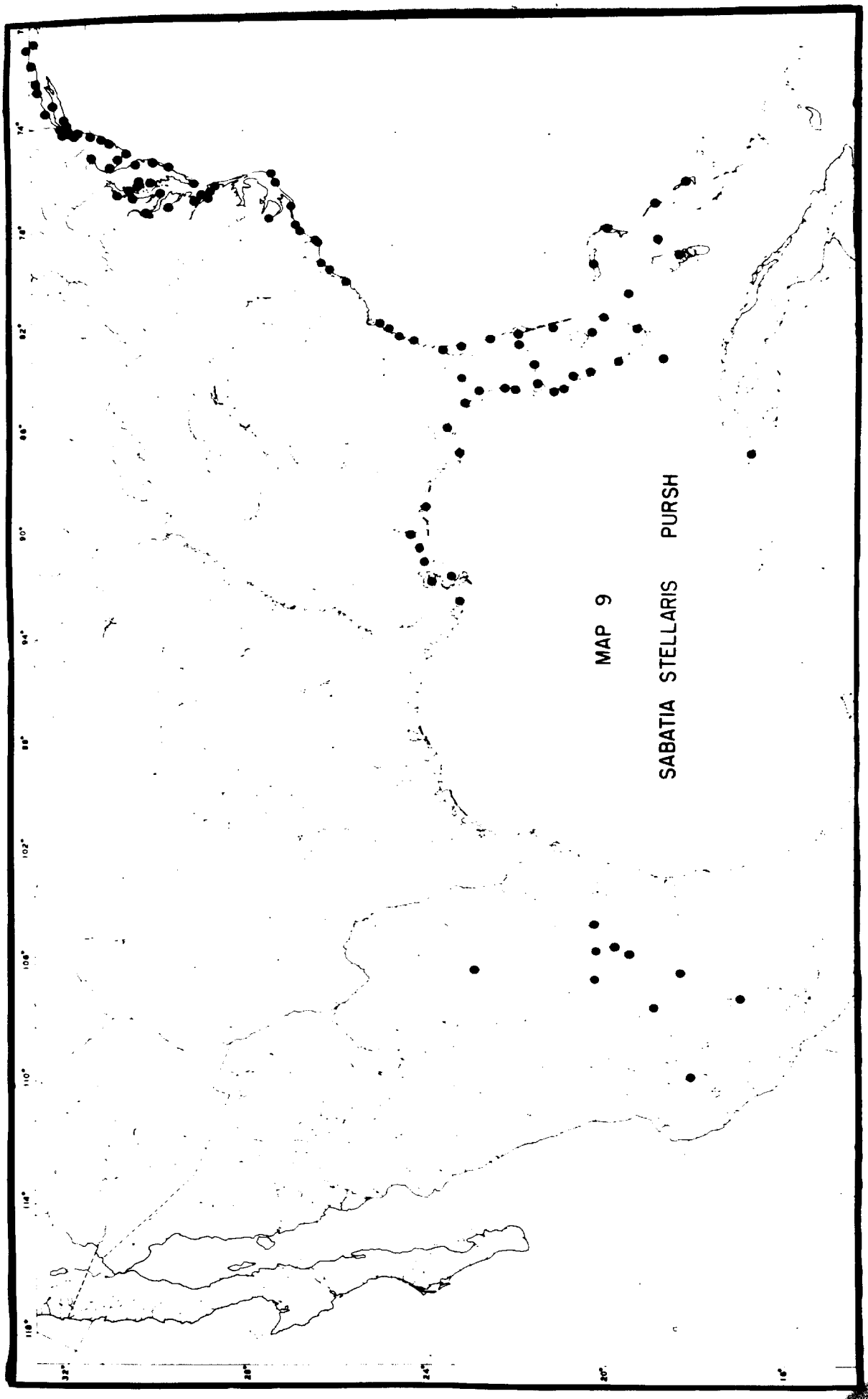
almost filiform, ascendent or more typically wide-spreading, (4)6--15(22) mm. long, typically less than 0.5 mm. but rarely as wide as 1 mm., usually 3--6 times as long as calyx tube, in general considerably shorter than the corolla, rarely equalling or exceeding it, apparently slightly hyaline-margined. Corolla tube about 2--3 times as long as wide, usually exceeding calyx tube by 1--3 mm., apparently greenish due to ovary, (3)4--6(8) mm. long. Corolla lobes strongly spreading, elliptic, oblong, spatulate, or obovate, obtuse to somewhat acute, (0.5)1--1.5(2)cm. long, (2)4--8(10) mm. wide, rose, pink, or more rarely white, with a usually irregularly 3-lobed yellow area at the base bordered by a distinct, bright- or dark-red line which in turn is sometimes bordred by a white area of variable width. Anthers linear, yellow, (2)3--4(5) mm. long; filaments pale-yellow to greenish (1.5)2--3(4) mm. long. Style 2--4 mm. long, usually about half the length of its branches; stigmatic lobes 3--8 mm. long. Capsule from almost globose to cylindrical, (4)6--8(10--14) mm. long, (3)4--5(6) mm. wide, usually 1.6--2 times as long as broad.

Type locality: "in salt marshes: New York, New Jersey &c."

DISTRIBUTION: Salt marshes and sandy (usually littoral) places from southern Massachusetts south along the coast and throughout much of Florida and west into Louisiana. Also known from the Bahamas, western Cuba, and central and northeastern Mexico.

MAP 9

Distribution of *Sabatia stellaris* Pursh


MAP 9
SABATIA STELLARIS PURSH

SPECIMENS EXAMINED.

MASSACHUSETTS: Bristol Co., Dartmouth, Hevey (GH); Dukes Co., Tisbury, Cushman July 1911 (WIS).

RHODE ISLAND: Washington Co., Westerly, Weatherby 3311 (NCS).

CONNECTICUT: Fairfield Co., Stratford, Eames 16 Aug. 1895 (NCU, NY, US); Middlesex Co., Old Saybrook, Weatherby 3771 (NCS); New Haven Co., Hammonasset Point near Madison, Evans 18 Aug. 1918 (YU); New London Co., Old Lyme, Woodward 1 Aug. 1918 (GH).

NEW YORK: Bronx Co., Kings Bridge, Austin Sept. 1861 (NY); Kings Co., Barren Island, Svenson 8242 (GA, GH, MO, PENN, TENN); Nassau Co., Long Beach, Pennell 2323 (NY); Queens Co., Arverne, Bicknell 7100 (NY); Richmond Co., vicinity of New Dorp. Small 2 Aug. 1890 (F, GH, MO, NA, NY, US, YU); Suffolk Co.,mouth of Wading River, Muenscher & Curtis 6420 (CU, GH, MT, NY, US).

NEW JERSEY: Atlantic Co., 0.5 mi. se. of Absecon, Fogg 4574 (MT, PENN, TENN); Burlington Co., Crowleytown, Long 4765 (PENN); Camden Co., Petty's Island, Smith 16 Aug. 1868 (PENN); Cape May Co., Cold Springs, Pennell 2179 (GH, MO, US); Cumberland Co., vicinity of Beaver Dam, Stone 24 Aug. 1910 (PENN); Essex Co., Arlington, Hunter July 1899 (NY); Hudson Co., Secaucus, Mackenzie 6765 (NJU); Monmouth Co., Avon, Mackenzie 1839 (NY); Middlesex Co., Sewaren,

Lighthipe 10702 (WIS); Ocean Co., Barnegat Pier, Mackenzie 3719 (NY, US); Salem Co., about 4 miles s. of Canton, Fogg 6054 (GH, PENN, TENN).

DELAWARE: Sussex Co., 2 mi. s. of Rehoboth, Larsen 989 (GA, PENN, US).

MARYLAND: Anne Arundel Co., near Churchton, Smith 4612 (US); Baltimore Co., Green's Sta., Plitt 860 (GH); Caroline Co., between Choptank River and Bethlehem, Killip 7278 (GH, US); Charles Co., Pope's Creek, Fassett 22297 (US, WIS); Dorchester Co., Fishing Creek, Earle 1627 (PENN, WIS); Queen Annes Co., near Matapeake, Ewan 17385 (NO); St. Mary's Co., Point Lookout, Blake 11267 (BPI); Talbot Co., 4.7 mi. s. by e. of Trappe, Earle 2343 (WVA); Worchester Co., Ocean City, Killip 7351 (GH, US).

VIRGINIA: Accomac Co., Chincoteague Island, Travis 620 (PENN); Elizabeth City Co., Fortress Monroe, Steele Aug. 1895 (US); Essex Co., north of Dunnsville, Fernald & Long 13422 (GA, GH, US); Northampton Co., beach at Cape Charles, Gleason 13 Sept. 1939 (DUKE, WVA); Norfolk Co., near Millville, Fernald & Long 13988 (GH, TENN); Princess Anne Co., along Back Bay, Fernald & Long 11113 (DUKE, GH, MO, NY, US); Surry Co., Hog Island, Fernald & Long 12774 (GA, GH, MO, US); York Co., ne. of Williamsburg, Grimes 4076 (GH).

NORTH CAROLINA: Beaufort Co., Blount Creek, Wells & Shelbourne 23 June 1938 (US); Bladen Co., without exact

locality, Ashe 285, confusion in labeling a strong possibility, (NCU); Brunswick Co., near Southport, Biltmore Herb. 3304a (GH, MO, NCU, NY, US); Carteret Co., Harker's Island, Godfrey & Blomquist 49776 (DUKE, NCS); Dare Co., Hatteras Island, Fosberg 17885 (NCS); Hyde Co., Ocracoke Island, Edwards 4 July 1940 (NCU); New Hanover Co., Fort Fisher on the Lower Cape Fear Peninsula, Godfrey 4726 (DUKE, GH, NCU, NY, US); Onslow Co., 5 miles n. of Surf City, Fox & Boyce 3752 (DUKE, MICH, NCS); Pender Co., about 1 mi. n. of New Topsail Beach, Fox & Boyce 3736 (MICH, NCS).

SOUTH CAROLINA: Beaufort Co., St. Helena Island, Cuthbert June 1902 (FLAS); Charles Co., Edisto Island, Hunt 3322 (CHARL, MICH); Georgetown Co., Pawley's Island, Godfrey & Tryon 306 (DUKE, F, GH, MO, NY, PENN, TENN, US); Horry Co., about 2 miles sw. of Ocean Drive, Wilbur 2901 (MICH).

GEORGIA: Chatham Co., Tybee Island, Harper 924 (GH, MO, NY, US); Glynn Co., Sea Island, Cronquist 5356 (FLAS, GA, GH, NO, SMU, US); McIntosh Co., near Darien, Correll 5462 (DUKE).

FLORIDA: Alachua Co., Gainesville, Crawford 12 Apr. 1897 (DUKE); Brevard Co., Titusville, Nash 2303 (F, FLAS, GH, K, MICH, MO, US); Broward Co., Hollywood, Moldenke 594 (DUKE, MO, NY); Charlotte Co., northeast of Murdock, West 10 Feb. 1939 (FLAS); Citrus Co., near Homosassa Springs, West & Arnold 24 June 1941 (FLAS); Collier Co., Caxambas Islands, Small 10493 (MO, NY, US); Dade Co., vicinity of

Black Point Creek, Small, Mosier & Small 6739 (GH, NY, US); Duval Co., near Jacksonville, Curtiss 4376 (MO, NY, US); Escambia Co., Santa Rosa Island, Brinker 503 (MO); Franklin Co., Apalachicola, Biltmore Dist. Chapman Herb. 3304b (GH, NY, US); Hernando Co., Bayport, McFarlin 6081 (MICH); Hillsborough Co., Tampa, Garber 1876 (F); Indian River Co., near Fellsmere, Small 8889 (NY); Lee Co., vicinity of Fort Meyers, Standley 12 (F, GH, MO, NY, US); Levy Co., 1 mile se of Chiefland, Webster & Wilbur 3639 (MICH); Manatee Co., Anna Maria Key, Cuthbert 21 Apr. 1917 (FLAS); Monroe Co., Big Pine Key, Small 8148 (DUKE, GH, NCU, NY, PENN, WVA); Orange Co., about 2 miles east of Ft. Chirstmas, Moldenke 210 (DUKE, MO, NY, PENN, US); Palm Beach Co., south of Lake Okeechobee, Small & Small 4458 (FLAS, DUKE, NY); Polk Co., without exact locality, Francis 9 mixed sheet (US); St. Johns Co., south of St. Augustine, Demaree 10165 (MO, US); Sarasota Co., Longboat Key, Tracy 6808 (F, MO, NY, US); Taylor Co., near Clara, Palmer 27303 (MO); Volousia Co., on Turtle Mound, Small, Small and DeWinkeler 11557 (NY); Wakulla Co., St. Marks, Chapman (GH).

ALABAMA: Mobile Co., without exact locality, Mohr Aug. 1892 (NY).

MISSISSIPPI: Harrison Co., Cat Island, Tracy Earle & Seymour 101 (CU, GH, MO, NCU, WIS); Jackson Co., Ocean Springs, Tracy 10 June 1898 (MO).

LOUISIANA: Jefferson Parish, south central Grande

Isle, Cungemi & Andrews 44 (NY); Orleans Parish, Gentilly, McArthur 23 Aug. 1928 (NO); Plaquemines Parish, Breton Island, Tracy & Lloyd 343 (CU, F, GH, MO, NY, US).

BAHAMA ISLANDS: Abaco Island, Brace 1793 (NY); Andros Island, Brace 7116 (F, NY, US); Cat Island, Britton & Millspaugh 5780 (F, NY); East Bimini, R. A. & E. S. Howard 10274 (SMU, US); Eleuthera Island, Britton 6427 (F, GH, NY, US); Great Bahama Island, Brace 3518 (F, NY, US); New Providence Island, Britton 58 TYPE of S. simulata (NY), Curtiss 200 (F, GH, MO, NY, US).

CUBA: without more exact locality but very likely from Pinar del Rio, Wright 412 sheets sometimes mixed with S. grandiflora (BRU, GH, NY, US). This is the same number but from different collecting trips by Wright as the type of S. gracilis var. cubensis, a very different plant.

MEXICO: Coahuila: Cuatro Cienegas, Marsh 2068 (F); Michoacan: 60--70 miles east of Lake Patzcuaro in bog 4 mi. west of Hidalgo, Hitchcock and Stanford 7196 (GH, UC). Jalisco: Lagos de Moreno, Hartweg 1615 TYPE OF Eustoma maculata Benth. (K); Rio Blanco, Palmer 668 TYPE of S. palmeri (GH). Queretaro: Queretaro, Arsene 10281 (US). San Luis Potosi: Media Luna near Rio Verde, Palmer 80 (F, GH, MO, NY, UC, US) and 80½ (GH, MO, NY, US); Minas de San Rafael, Purpus 5345 TYPE OF S. purpusii at the University of California (F, GH, MO, NY, UC); Hacienda de Angostura, Pringle 3810 (BRU, F, GH, MICH, MO, NY, UC, US);

Las Tablas, Pennell 18048 (US); Tamaulipas: Jaumave, Rozynski 377 (F).

Sabatia stellaris is doubtless the most variable species in subsection Campanulatae but within this wide range of diversity there appears to be no sharply differentiated population that might be more naturally treated as a subspecies or a variety. Rather there is a gradual and almost imperceptible change and as a consequence specimens from the northern limits of the range are often very strikingly different from those seen at the extreme southern portion of its distribution. Typically plants collected in southern Florida are taller, more profusely branched, often from near the base, and these branches are much more elongate, wiry, and slender. The leaves for the most part are narrowly linear and only the uppermost ever possess indications of a more elliptical or spatulate nature. The northern material is on the average smaller and less branched, with the branching usually restricted to the upper portion of the stem; the branches are usually short and bearing few nodes. The leaves are usually linear in the very upper portion of the stem, the lower ones often being broadly elliptical. The sum of these differences results in plants of very dissimilar appearance. Examination of an ample series taken from throughout the range will convince one, I believe, that these differences are not sufficient for the recognition of subspecific categories. Rather these differences should in part be attributed to the great

diversity in environment encountered through the range of more than twenty degrees of latitude and expecially to the difference in the length of the growing season between the Massachusetts coast and the shores of the Carribean.

After initially attempting (1903) to distinguish between S. campanulata and S. stellaris, Small abandoned the effort and thereafter recognized only one species as occurring within the southeastern states and applied the former name to specimens of both species. The confusion between those species is understandable due to the often misleading distinguishing criteria published in most works previous to the detection of the strikingly obvious differences by Bicknell (Bull. Torrey Club 42:30-32) and especially by Fernald (Rhodora 18:145-147). Thereafter there should have been little difficulty in distinguishing the two. The greater part of the southern material of S. stellaris has passed as S. campanulata or the larger-flowered specimens as S. grandiflora as a result of Small's work. S. campanulata is not known in peninsular Florida and the inclusion of the name of that perennial in his "Flora of Miami" (1913) and also in the "Flora of the Florida Keys," which he published in the same year, is based upon specimens of the two annual species.

It should also be pointed out that although the species is rather closely confined to the littoral region in the northern part of its range, specimens from inland peninsular Florida are fairly numerous. In spite of the environmental information available in the literature, S. stellaris, at least in the southern part of its range, is not

restricted to a salt-marsh environment and in fact is at least more commonly collected in sandy open areas. I have seen it quite abundantly along the sandy shoulder of the road several miles inland in South Carolina and at least twenty miles inland in a similar environment in Florida. The greater availability of such habitats in Florida may perhaps explain in part those inland collections.

Britton (Bull. N. Y. Bot. Gard. 3: 448. 1905.) and later Britton & Millspaugh (1920) recognized two species as occurring in the Bahamas, S. campanulata and the supposedly endemic S. simulata. The latter species was to be distinguished from what they called S. campanulata by its more slender habit and smaller white flowers. All the material of this genus seen from the Bahamas has proved to be annual and consequently the larger-flowered plants with the rose-pink corollas are definitely not S. campanulata; they are S. stellaris. There is no break in flower size between the pink and white flowered specimens although the latter are on the average smaller. Several of the larger-flowered specimens (2.5 cm. or more in diameter) had been designated by Britton as S. simulata apparently on the basis of the flower color. The stigma of S. simulata was described as "spatulate" in contrast to the "oblong-linear" stigma of "S. campanulata". I was unable to discover any consistent difference between the stigmas of the specimens. There was the usual variation dependent upon age. S. simulata is, I believe, merely a white-flowered form of S. stellaris and is conspecific with the pink-flowered specimens of the

Bahamas. These color phases are indistinguishable from much of the material from southern Florida, and, for the present at least, all had best be treated as another trend in the variation apparent in this species throughout its extensive range.

The synonymy of the species in eastern North America, although extensive, has been well understood and has consequently caused little or no confusion for most of the century and a half that the plant has been known to science. A recent exception to that was Fernald's acceptance (Rhodora 34:26-28. 1932.) of S. amoena as the legitimate name for the entity and this misunderstanding was not corrected by him for almost ten years. Then (Rhodora 43:629. 1941.) he pointed out that although Salisbury's name was illegitimate, being merely a substitution for a Linnean name, it still was validly published and hence made Rafinesque's illegitimate also.

One name which does deserve discussion is S. nana of Featherman, which has not been listed in "Index Kewensis" and which was discovered quite by chance in tracing down that same author's S. oligophylla. The description is here quoted in full:

> Sabbatia Nana. -- Stem simple, low, somewhat angled. Leaves small, sessile, the lower spatulate lanceolate, the upper linear lanceolate. Lobes of the corolla five to six, one third longer than the narrow linear calyx lobes. Root perpendicular, slender, Flowers rose-colored. Stem three to four inches high. Blooms in August.
>
> Habitat--Marshy soil of Grande Isle.

The diagnosis is certainly brief but the shape of the leaves, the "narrow linear" calyx lobes two-thirds as long as the corolla, the habit and the habitat all together make it quite certain that S. stellaris was the plant being described. This Louisianan record is at or near the westernmost extremity of the species' present known range in the southeast.

The types of S. maculata, S. palmeri, and S. purpusii have all been examined and compared both with the few additional Mexican collections of the genus that have been made and with specimens of the widespread species of eastern North America. Two of the groups of specimens seemed very different from each other and at first I thought that I could easily distinguish them both from any others in the genus. S. palmeri, on the other hand, very quickly seemed to be identical, or at least indistinguishable from S. maculata. Upon examination of more material, especially a larger sample of S. stellaris from Florida, it became obvious that any of the Mexican specimens could be matched or very nearly matched by a considerable number of plants of S. stellaris. I am certain that I could not distinguish between or sort into their "respective piles" a large unlabeled series of specimens collected in Florida and another large series collected in Mexico. Therefore all three names are here treated as synonyms of S. stellaris, a wide-ranging variable species.

The blackened patches at the base of the corolla-lobes of the type of S. maculata are very striking and the epithet chosen by Bentham points out this feature. The

dark black color can certainly be attributed to discoloration upon drying and has been noted in many specimens found as far north as New Jersey. The type itself seems indistinguishable from many specimens from Florida of which Cuthbert 1525 (FLAS) from Mamatee County is a good example. S. palmeri is very similar in appearance to S. maculata.

S. purpusii is also indistinguishable from many of the wiry Floridian specimens. For example Pennell's collection (18048) from the state of San Luis Potosi seems remarkably similar to the collection of Hood (3565) among others from western peninsular Florida. In the Mexican specimens a tendency was noted for the calyx tube to be more cylindrical with sides more parallel rather than strongly tapering and whose length is typically in the upper range of that of the specimens from the eastern United States. Also the few capsules seen in the Mexican specimens of the purpusii aspect appeared to be more slender and longer than those of most of the specimens seen from the principal area of distribution of the species.

The disjunct distribution of this species is perplexing. Fernald (Rhodora 18:146. 1916.) stated that the range of S. stellaris was from "Massachusetts to eastern Mexico" and at that time he considered the plants called by some S. purpusii as part of this wide-ranging species as is shown by his annotation lables. In the most recent edition of Gray's Manual the western limit of the range was stated to be Louisiana. The apparent absence of this species from the Texas coast and its reappearance in eastern Mexico well

south of the border, and most surprisingly of all in the central plateau of that country, is not easily explained. It was with considerable reluctance that attempts to recognize any of these species were abandoned but there seems to be no alternative than to treat them all as synonyms. The absence of the plant from Texas is in particular inexplicable as there seem to be enormous stretches of territory offering what would seem to be an environment similar to that in which it is found so abundantly in the Atlantic and Gulf Coastal Plain.

This treatment seems now to be the only tenable one but extensive field-work, further collections at the periphery of its range in particular, and adequate notes as to environment and details of its appearance which disappear from prepared specimens may show that the recognition of subspecific categories might account more satisfactorily for the perplexing range of variation known to exist.

10. Sabatia grandiflora (A. Gray) Small

Sabbatia gracilis var. grandiflora A. Gray. Syn. Fl. N. Am. 2: 115. 1878.

Sabbatia grandiflora (A. Gray) Small, Fl. SE. U.S. 928. 1903.

Sabatia campanulata var. grandiflora (A. Gray) Blake, Rhodora 17: 52. 1915.

Sabbatia Alainii Marie-Victorin, Contr. Inst. Bot. Univ. Montreal no. 63: 73. 1948.

Erect annual (15)40--90(110) cm. high; stem (1)2--

5(7) mm. in diameter, terete, although in dried specimens with several fine lines running between the nodes. Branches rarely absent, almost entire restricted to the upper third or half of the stem, almost invariably alternate, typically strongly divergent, forming angles of about 50--70 degrees, stiffly geniculate, bearing but few nodes and with rigid, elongate internodes. Plant appearing virgate from elongate, abruptly divaricate, rigid internodes. Root system of several to numerous fibrous roots 3--8 cm. long, 1--3 mm. in diameter. Leaves erect, closely appressed against the stem, at least above, succulent, drying thick, stiffly rigid, rugose-roughened, venation obscured in both living and dried material; the lower spatulate, elliptic, oblong-linear or even linear, obtuse to acute, (1)2--4(5) cm. long, (2)4--7(10) mm. wide, typically about 5--10 times longer than wide, usually several times exceeding the typically short, 0.5--3 cm. long internodes; gradually to abruptly reduced above to very narrowly linear or even filiform, the width noticeably less than the diameter of the stem, (1)3--5(12) cm. long, (0.5)1--2(3) mm. wide, generally 20--60 times as long as wide, hyaline or callose apiculate-tipped. Internodes above typically greatly elongate, often 2--5 times as long as the leaves. Inflorescence of (1)2--3(4)-flowered dichasia of reduced cymules; the flowers borne on slender, but rigid, elongate, terete pedicels (2)4--8(12) cm. long and about 0.5 mm. in diameter; the flowers thus appearing solitary. Calyx tube campanulate,

usually broadly so, the sides more or less parallel, abruptly contracting to base or but gradually tapering in the lower half, typically 1--1.5(2) times as long as broad, 2--4(6) mm. long, generally very smooth or but very finely lined, the wall thin and somewhat hyaline-scarious especially with age. Calyx lobes erect to spreading, very narrowly linear to filiform, (0.6)1--2(3) cm. long, usually about 3--6 times as long as the tube, typically less than three-fourths as long as the corolla, rarely equalling or exceeding it, the tip callose-apiculate. Corolla-tube cylindrical, (3)5--7(8) mm. long, exceeding calyx tube by about 2--4 mm., usually 1.5--2 times as long as wide, apparently colorless. Corolla lobes strongly spreading, oblanceolate, obovate, broadly spatulate, oblong, or elliptic, usually obtuse or more rarely acute, (1.3)1.8--2.5(3) cm. long, (5)7--12(15) mm. wide, deeply roseate to pale-pink or white, with oblong basal yellow area 2--4 mm. long, rather irregularly lobed or toothed, and in the roseate forms usually bordered by a deeply intense red line or area. Anthers linear, dark-yellow, (3)5--7(8) mm. long; filaments yellow, slender, 2--4 mm. long. Style 2--5 mm. long; stigmatic lobes (4)6--8(9) mm. long. Capsule usually narrowly cylindrical, (6)8--10(15) mm. long, 4--5(7) mm. wide, generally 2--3 times as long as broad.

Type locality: "Coast of E. Florida." Lectotype: Palmer 430 (GH) from "Indian River."

DISTRIBUTION. Everglades, pinelands and sandy places in peninsular Florida and western Cuba.

MAP 10

Distribution of *Sabatia grandiflora* (A. Gray) Small



MAP 10

SABATIA GRANDIFLORA (A. GRAY) SMALL

SPECIMENS EXAMINED:

FLORIDA: Alachua Co., Earlton Beach, Loucks 5 Sept. 1927 (FLAS); Brevard Co., between Cocoa and Lake Poinsett, Rhoads 23 May 1937 (FLAS); Broward Co., Ft. Lauderdale, Small & Wilson 1785 (NY); Charlotte Co., without exact locality, Frye 17 May 1946 (FLAS); Clay Co., Keystone Heights, West 29 June 1930 (FLAS); Collier Co., 2 miles south of Immokalee, Sheehan 28 Feb. 1919 (NY); Dade Co., west of Camp Jackson, Small & Wilson 1991 (NY); DeSoto Co., Lacy, West 23 Sept. 1938 (FLAS); Duval Co., without exact locality, Fredhold 5 (GH); Glades Co., Lakeport, Lovett 264 (DUKE); Hardee Co., Limestone, Kirk 1 July 1942 (FLAS); Hendry Co., southeast comer of county, Davis 13 Sept. 1947 (FLAS); Hernando Co., without exact locality, Hitchcock 1283(F, MO); Highlands Co., near Brighton, McFarlin 10913 (GH, PENN); Hillsborough Co., Tampa, Garber May 1876 (BUR, F, NY, US, YU); Indian River Co., near Felsmere, Small 8917 (NY); Lake Co., Eustis, Nash 763 (CU, F, GH, MICH, MO, NY, US); Lee Co., about 8 miles southeast of Fort Meyers, Standley 446 (F, GH, MO, MT, US); Levy Co., Bronson, Watson & Murrill 18 June 1939 (FLAS); Manatee Co., near Palma Sola Bay, Cuthbert 23 June 1916 (FLAS); Marion Co., Lake Kerr, West & Arnold 21 July 1935 (FLAS); Martin Co., Stuart, Atwood 1917 (CU); Okeechobee Co., north of Fort Drum, R. & E. West 22 Apr. 1946 (FLAS); Orange Co., near Oakland, Curtiss 6624 (CU, GH, MO, NY, US); Osceola Co., Kissimmee, Singletary 136 (DUKE, NCU); Palm Beach Co., along the Palm Beach Canal, Small 8280 (FLAS, NY, TENN);

Pasco Co., near Zephyrhills, Hood 3483 (FLAS); Pinellas Co., near St. Petersburg, Deam 1901 (MICH); Polk Co., north of Davenport, Hood 3546 (FLAS); Putname Co., Welakea, De Vall 23 June 1939 (FLAS); Sarasota Co., Myakka River State park about 18 miles southeast of Sarasota, Wilbur & Webster 2502 (MICH); Volusia Co., near Ariel, Moldenke 180a (NY, PENN); county unknown, Indian River, Palmer 430 LECTOTYPE of S. gracilis var. grandiflora (F, GH, NY).

CUBA. PINAR DEL RIO: au bord des lagunes de Santa Maria, San Luis, Marie-Victorin & Alain 369 TYPE of S. Alainii (GH, MT); Morders of Laguna Santa Maria, Britton, Britton & Gager 7166 (NY, US). Province not stated, Wright 412 sheets sometimes mixed with S. stellaris (BRU, NY, US).

In spite of the numerous striking characteristics which distinguish this species from any other, far too great a reliance has been placed upon the size of the flower as the chief criterion for the recognition of S. grandiflora. As a consequence one finds that in most herbaria a miscellaneous assemblage of large-flowered specimens belonging to subsection Campanulatae have been masquerading under that name. Small never pointed out the distinctive characteristics which make S. grandiflora a clear-cut and natural entity and a considerable portion of the specimens labeled or annotated by him are merely large-flowered S. stellaris. The identity of these mistakenly-

identified specimens is clearly shown by the smooth, thin texture of the dried leaves which, although narrowly linear above, are typically as broad or broader than the diameter of the stem. Also these large-flowered specimens of S. stellaris, which have been so often mistaken for S. grandiflora, are generally more profusely branched especially below the middle of the stem. S. grandiflora may be readily distinguished from S. stellaris by its thick rugose-roughened or wrinkled leaves which are filiform above, and less than the diameter of the stem in width. Furthermore, it is typically a larger and coarser plant with branching more or less restricted to the upper third or half of the stem. Another fairly reliable characteristic that may be utilized in recognizing S. grandiflora is that its calyx tube is most often broadly campanulate while that of S. stellaris is more typically narrowly turbinate. That much relied upon character, the length of the corolla lobes, is at best a subsidiary character due to the broad overlap between the size range of the two species.

In spite of the inferences that might be derived from the synonymy, the relationship of S. grandiflora is closer to S. stellaris than to S. campanulata (= S. gracilis). Numerous differences between S. grandiflora and S. campanulata with which it was originally and even later considered to be a variety might be mentioned. However, the most obvious and perhaps most fundamental distinction is that the latter is a caespitose perennial while S. grandiflora,

like S. stellaris, is an annual. The perennial species is not known in peninsular Florida. S. stellaris has been collected throughout the state, especially near the coast. In Florida, S. grandiflora is almost entirely restricted to the peninsular portion. It might be pointed out again that the environmental range of S. stellaris seems to be considerably wider in Florida than elsewhere. There it seems to be more narrowly restricted to the coast. Judging from the number of mixed sheets of S. stellaris and S. grandiflora, it seems certain that there must be a considerable overlap in range of habitat between these two species if their environmental tolerances are not exactly the same in Florida. In the United States other than in Florida S. grandiflora is known only from a specimen attributed to Josiah Hale from Louisiana in the Gray Herbarium. This collection is certainly S. grandiflora but more recent collections from Louisiana seen in the herbaria under this name have always proved to be large-flowered specimens of S. stellaris. It would seem that for this specimen confusion in labeling should be considered a strong possibility, at least until a better substantiated collection is seen from that state. If Louisiana were part of the range of the species, other specimens would, I think, be expected in view of the comparatively extensive collection of more recent date.

After the short original diagnosis, Gray presented the then known range together with at least some of the collections known to him in the following manner: "coast

of E. Florida, Leavenworth, Buckley, Palmer &c." Theirs were the only specimens available to him that are now preserved in the Gray Herbarium or at the New York Botanical Garden; who the other collectors were is problematical. There are sheets of S. grandiflora collected by Buckley at both the Gray Herbarium and the Missouri Botanical Garden which are presumably duplicates although the one at Gray is labeled"E. Florida" and that at St. Louis merely "Florida!" The latter sheet is a mixture containing recognizable but miserable specimens of S. stellaris as well as S. grandiflora. There are also two Leavenworth specimens but these are probably not duplicates since the sheet at Gray is labeled "E. Florida" and that at New York, "Tampa Bay, Fla." which is on the western side of the peninsula. Palmer's collection, made in 1874, is definite and all four sheets at the three different herbaria bear the information "Indian River, East Florida" as well as the number "430." These specimens are also equal to or better than the others and, in spite of being collected after a varietal status had been decided upon (with another epithet) based on the other collection, Palmer's collection 430 at the Gray Herbarium is designated as the lectotype.

The recently proposed S. alainii does not appear distinct and here is considered to be a synonym of S. grandiflora; its distinctiveness has certainly not as yet been demonstrated. The original very thorough description of this supposedly distinct Cuban entity was accompanied by the following discussion in reference to its relationship

with S. grandiflora. "Cette espèce se rapproche du Sabbatia grandiflora par sa grande corolle, ses curtes feuilles, l'absence d'oeil jaune, sa capsule plus petite." It appears as though a word or so had been omitted in printing and that the first two characters mentioned were meant as features shared in common by S. grandiflora and the newly proposed species and that the second two phrases were supposed distinctions. The stated absence of the yellow eye in the throat of the corolla tube and at the base of the lobes of S. alainii is not borne out by examination of either the type material, distributed isotypes or information ("white with light yellow eye") provided on the label of Britton et al. 7166 which was collected in the same region. The few capsules available were smaller but did not appear to have fully developed. The Cuban representatives of this group are, I believe, indistinguishable from the Floridan.

11. Sabatia brevifolia Raf.

Sabbatia paniculata in the sense of Ell., Sk. Bot. S. C. & Ga. 1: 282. 1817, not Michx. Fl. Bor.-Am. 1: 146. 1803 or Pursh, Fl. Am. Sept. 1: 138. 1814.

Sabbatia brevifolia Raf., Atl. Jour. 1: 147. 1832.

Sabbatia Elliottii [as Elliotii] Steud., Nom. Bot., ed. 2. 2: 489. 1841.

Sabbatia paniculata β Elliottii Steud. Wood, Am. Bot. & Flor. 266. 1870, without basic synonym.

Erect annual (15)30--60(70) cm. high; stem (1)2--

3(4) mm. in diameter, terete, but usually finely ridged or lined by slight elevations extending between the nodes, pith hollow at least below. Branches typically alternate and always so above, but in robust, profusely branched plants occasionally with few to several branches of the main stem and even near base of principal branches are opposite; in large well-developed plants usually branching throughout the length of the stem, in smaller plants often restricted to the upper half of the stem, strongly ascendent to more commonly widely divergent, usually forming an angle with the stem of (2)40--60(80) degrees, slender, wiry, usually bearing numerous nodes, the internodes not elongated; the aspect of the plant very strikingly wiry-virgate. Root system a pronounced slender or occasionally thickened taproot 2--8 cm. long, (1)2--3(4.5) mm. in diameter, bearing few to several very slender laterals. Leaves ascendent and apparently appressed on the main stem and the more or less vertical branches but on strongly divergent branches usually strikingly upwardly secund and often appearing falcate, midvein alone easily detected and that elevated beneath, apex very minutely apiculate, the lowermost somewhat obovate, oblanceolate, oblong, elliptic, or linear, (0.5)1--2(3) cm. long, (1)2--5(7) mm. wide, typically obtuse or sometimes acute, usually tapering to the sessile base, generally 3--6 times as long as wide; those from about the middle of the stem narrowly oblong or more commonly linear, 1.5--2.5 cm. long, 1--3 mm. wide, acute; the uppermost cauline and those of the branches narrowly linear to filiform or even

subulate, gradually reduced to about 3--5 mm. long and less than 2 mm. wide or twice the diameter of the stem or often the same width, usually 10--25 times as long as broad. Internodes usually 1--2 times the length of the leaves, occasionally greater or sometimes, especially near the base, less. Flowers appearing solitary but arranged in reduced often 1--2-flowered cymules usually secundly borne on the upper side of the divaricate branches on very slender, wiry erect pedicels or peduncles (1)2--4(5) cm. long. Calyx tube turbinate, sides sloping to the base, smooth or rather noticeably finely nerved, internerval wall thin, often scarious, about 1--2 times as long as broad, (1)1.5--2.5(3) mm. long. Calyx lobes setaceous or subulate, ascendent to wide spreading, (3)4--7(8) mm. long, tapering from about 0.5--1 mm. base, usually 2--4 times as long as the calyx tube, usually not exceeding half the length of the corolla. Upper half of the corolla tube usually cylindrical, tapering below middle to the base, about 1.5--2 times as long as wide, usually 1--2 mm. longer than the calyx tube or about 2 times as long, (2.5)3.5--4.5(5) mm. long. Corolla lobes spreading, elliptic, oblong, oblanceolate, or broadly spatulate, (0.6)0.9--1.3(1.8) cm., (2)3--5(7) mm. wide, usually obtuse but not uncommonly somewhat acute, white with a greenish-yellow to yellow patch at base of lobe. Anthers linear, yellow, (2)3--5(6) mm. long; filaments greenish-yellow to pale-yellow, 1--2 mm. long. Style 1 mm. long or less; stigmatic lobes 3--5 mm. long. Capsule cylindrical, 3--6 mm. long, 2--4 mm. wide.

Type locality: Florida. Type: unknown. Described by Rafinesque along with thirty other species from Florida "seen in gardens and herbals."

DISTRIBUTION: Pinelands and savannas from southeastern South Carolina along the Coastal Plain throughout most of Florida and west at least to Alabama.

SPECIMENS EXAMINED.

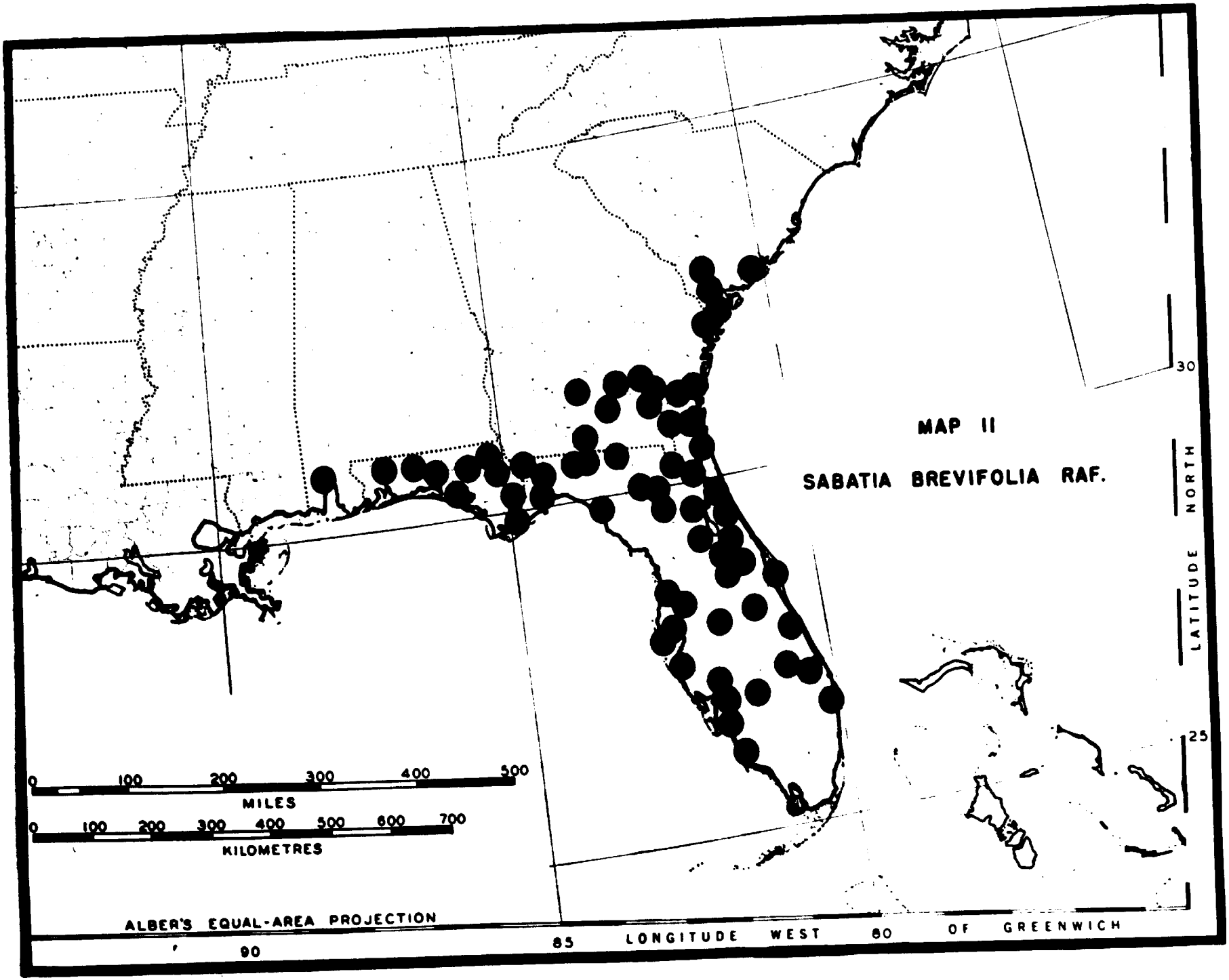
NORTH CAROLINA: without locality, Delile (NY). Since this species is not otherwise known north of Charleston S.C., its presence in North Carolina seems most doubtful.

SOUTH CAROLINA: Beaufort Co., Bluffton, Mellichamp 1886 (F, MO, NY, US); Charleston Co., Adams Run, Godfrey & Tryon 1544 (DUKE, F, GH, MICH, MO, NY, PENN, TENN, US); Hampton Co., about 4 miles southeast of Hampton, Wilbur & Webster 2825 (MICH); Jasper Co., Ridgeland, Mohr Nov. 1893 (MO, NY, US).

GEORGIA: Bacon Co., e. of Alma, Duncan 3988 (GA); Berrien Co., Alapaha Forest, Lemon 23 Aug. 1943 (FLAS); Brantley Co., 3 miles east of Nahunta, Wilbur & Webster 2749 (MICH); Bryan Co., near Lanier, McKay 14 Aug. 1930 (GA); Brooks Co., just north of Quitman, Duncan 2968 (MICH); Camden Co., west of St. Marys, Small, DeWinkeler & Small 10545 (DUKE, WVA); Charlton Co., Okefenokee Swamp between Chesser Island and Cornelia, Thorne & Ford 2064 (CU, GA); Chatham Co., between Savannah and Bonaventure, Duggar

MAP 11

Distribution of *Sabatia brevifolia* Raf.


MAP II
SABATIA BREVIFOLIA RAF.
30
25
LATITUDE NORTH
0 100 200 300 400 500
MILES
0 100 200 300 400 500 600 700
KILOMETRES
ALBER'S EQUAL-AREA PROJECTION
90
85
LONGITUDE WEST
80
OF GREENWICH

31 Aug. 1913 (MO); Coffee Co., without exact locality, Harper 681 (NY, US); Glynn Co., near Brunswick, Freeman 14 Oct. 1937 (NA); Pierce Co., 3 miles north of Blackshear, Thorne & Norris 6202 (CU, GA); Tift Co., west of Tifton, Thorne & Norris 6589 (GA); Ware Co., 5 miles southeast of Waycross, Wilbur & Webster 2731 (MICH).

FLORIDA: Alachua Co., Kelley's flatwoods, Murrill 477 (US); Baker Co., Macclenny, Knight 25 Oct. 1944 (FLAS); Bay Co., near West Bay, Hood 3346 (FLAS); Bradford Co., w. of Lawtey, Murrill 9 Sept. 1940 (FLAS); Brevard Co., Merritts Island, Curtiss 2227 (F, GH, MO, NY, US); Calhoun Co., Altha, West 9 Sept. 1931 (FLAS); Charlotte Co., without exact locality, Frye c-30 (FLAS); Clay Co., about 2 miles north of Orange Park, Moldenke 162 (DUKE, MO, NY, PENN, US); Collier Co., Naples, Scull 25 July 1937 (FLAS); Columbia Co., w. of Lake City, Murrill 10-6-40 (FLAS); DeSoto Co., 4 miles west of Arcadia, Webster 4224 (MICH); Dixie Co., 4 miles ne. of Jena, Pasture Survey 19 Aug. 1937 (FLAS); Duval Co., near Jacksonville, Curtiss 5114 (CU, G, GH, NCS, NY, US); Flagler Co., near St. John's Park, West & Arnold 25 June 1942 (FLAS); Franklin Co., Apalachicola, Biltmore Herb. Dist, Chapman Herb. 903b (GH, MO, NCS, NCU, NY, PENN, US); Glades Co., Palmdale, Davis 6 Oct. 1941 (FLAS); Gadsen Co., near Wetumpka, Small, DeWinkeler & Mosier 25 Nov. 1923 (NCU); Hamilton Co., 3 miles east of Jasper, West & Arnold 30 Sept. 1941 (FLAS); Hernando Co., between Brookside and Bayport, Jones 43 (CU, US); Hills-

borough Co., Tampa, Nash 2422 (F, GH, MICH, MO, MT, NY, US); Indian River Co., near Felsmere, Small 8902 (FLAS, GH, NY US); Jackson Co., 4 miles east of Marianna, Wiegand & Manning 2559 (CU, GH); Jefferson Co., 2 mi. w. of Aucilla, Murrill 7 Oct. 1940 (FLAS); Lake Co., near Cassia, Hood 1 Sept 1911 (FLAS, GH); Lee Co., south of Fort Meyers, Moldenke 909 (DUKE, MO, NY, PENN, US); Leon Co., near Tallahassee, Berg 1894 (NY); Liberty Co., near Roy, Wiegand & Manning 2558 (CU, GH); Madison Co., near Greenville, Murrill 10-6-40 (FLAS); Manatee Co., Bradenton, Tracy 7080 (CU, F, FLAS, GH, NY, PENN, TAES, US); Marion Co., at Juniper Springs, Murrill 13 Oct. 1940 (FLAS); Martin Co., east of Indian Town, Small, Mosier & DeWinkeler 10886 (NY); Okaloose Co., Crestview, Barrow 9 Oct. 1939 (FLAS); Okeechobee Co., northern end of Lake Okeechobee, Small & Small 4361 (NY); Orange Co., about 2.5 miles northeast of Apopka, Wilbur & Webster 2650 (MICH); Osceola Co., Holopaw, Hood 4235 (FLAS); Pasco Co., near San Antoniao, Barnhart 2894 (NY); Palm Beach Co., Earman, Randolph 26 (CU, GH); Pinellas Co., about 4 miles west of St. Petersburg, Deam 2840 (MICH, US); Polk Co., Winter Haven, McFarlin 2950 (MICH); Putnam Co., 10 mi. se of Interlochen, Fox 5700 (MICH); St. Johns Co., near Spuds, West & Arnold 14 Oct. 1941 (FLAS); St. Lucie Co., without exact locality, Davis 23 Nov. 1942 (FLAS); Santa Rosa Co., near Roseville north of Milton, Hood 3243 (FLAS); Seminole Co., Lake Monroe, Garber Mar. 1896 (BRU, F, US, YU); Taylor Co., 5 miles east of Steinhatchee, Rhoads 6 Sept. 1943 (FLAS); Union Co.,

Worthington Springs, Kelbert & West 81 (FLAS); Volusia Co., Beresford, Hood 21 Sept. 1910 (FLAS, MO); Wakulla Co., inter St. Marks et Port Leon, Rugel Aug, 1943 (NY); Walton Co., south of DeFuniak Springs, Hood 3053 (FLAS); Washington Co., between Vernon and Chipley, Hood 2827 (FLAS).

ALABAMA: Mobile Co., between Theodore and Hollander's Island, Pennell 4512 (NY, PENN).

LOUISIANA: without locality data, Featherman (MO). This species should not be included in the flora of this state without a better substantiated record than this. It seems very likely that there is confusion in labeling in regard to this collection.

Although it is rather difficult, if not impossible, to point out separate characters that absolutely distinguish this species from all specimens of S. stellaris, which it most closely resembles, the ensemble of characters is so distinctive that once visualized this entity becomes one of the easiest of all the sabatias to identify. While S. stellaris is a species that apparently embraces a wide range of variation, S. brevifolia is quite homogeneous. The ease of recognition has almost been a characteristic of the plant and its identity has been no real problem since it was originally described. These distinctive features have been pointed out in the key and need not be repeated here.

The nomenclature of the species has been confused, and it appears that another change is necessary. The

species was described originally and very excellently by Elliott with the acknowledged aid of Baldwin but the name applied to it was Sabatia paniculata. This erroneous nomenclature was generally employed even after it was understood to be a mistake. Chapman (1860) was persuaded by Gray to take up the substitute name originally proposed by Steudel nearly twenty years before. Elliott's application of Michaux's epithet, which initiated the confusion, is curious in view of his full understanding of the subject as shown by the following quotation:

> Though the description of Michaux applies more peculiarly to the S. corymbosa, yet as this species was certainly included, and is the only one to which the term paniculata is certainly applicable, I have referred to him here.

This change in concept of the species passing under the epithet paniculata was pointed out by Grisebach (1839) but he chose to continue the use of the name in the sense of Elliott. Steudel simply substituted the epithet elliottii, as Elliotii, citing in synonymy "S. paniculata Ell. (non Pursh)." The original spelling of the name need not be retained in such a case as this as it was clearly an unintentional orthographic error which may be corrected (Art. 70 Int. Rules Bot. Nomencl.). Steudel, in listing Stephen Elliott's name in the "Nomina Autorum Citatarum" at the end of his book, spelled the name again "Elliot." It seems hardly possible that someone would carry the prerogative of modifying a name when latinizing it to a bibliographic listing; the change must have been unintentional. Wood's solution to the confusion that had enveloped the nomencla-

ture of the white-flowered sabatias was to reduce S. elliottii to varietal status of S. paniculata. This indicated little more than a vague bibliographic rather than biological, familiarity with the plants.

Nine years before Steudel's publication of S. elliottii, Rafinesque in a paper describing over thirty species from Florida belonging to various genera "seen in gardens and herbals" published S. brevifolia, the original description of which is here quoted in full:

> 8. -Sabbatia brevifolia Raf. Stem dichotomous filiform, leaves short subulate acute, flowers terminal white, calyx shorter than corolla setaceous, segments of corolla obovate. Near to S. brachiata and stellaris.

This description, although very brief, seems very apt in pointing out the stronger features that characterize the species that has long been called S. elliottii. Even in the absence of an authentic specimen I feel no hesitation in taking up Rafinesque's name other than that caused by the natural regret of seeing a well established name replaced by one long forgotten. It would be difficult to present a better description in so few words of the plant first characterized by Elliott than Rafinesque's attempt. Every descriptive phrase fits Elliott's plant very well. If the description were not of that plant, it could only be a very poor and inaccurate description of a most unusual S. stellaris. There seems then to be no other alternative than to adopt Rafinesque's prior name. The application of the strict rule of priority and more thorough bibliographic research are making Rafinesque's prediction that "time

renders justice to all at last" increasingly true.

Subsection DODECANDRAE subsect nov.[1]

Subgenus Plurimaria Raf., Med. Fl. 2:76. 1830 in part, not Plurimaria Raf. (as genus), Fl. Tell. 3:31. 1837.

Pleienta Raf., Fl. Tell. 3:30. 1837 in part, an illegitimate name.

Section Eusabbatia Griseb., Gen. & Sp. Gent. 120. 1839, in part.

Section Pleienta (Raf.) Blake, Rhodora 17:56. 1915, an illegitimate name.

Dodecandrae (a category of vague and undesignated status), Small, Man. SE. Fl. 1049. 1933.

Rhizomatose perennials with at least the secondary and very often the primary branches alternate. Strongly pronounced tendency toward plurimerous flowers ranging from 5--12(14)-parted. Flowers typically large and pedicels usually longer than 1 cm.

TYPE SPECIES: Sabatia dodecandra (L.) B.S.P.

This subsection contains four species which, except for one species, are restricted to the Coastal Plain of the United States. S. calycina also occurs on at least two

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[1]Subsectio Dodecandrae. Perennes rhizomatibus praeditae. Rami secondarii et interdum primarii alterni. Flores saepe plurimeres, inter 5-partiti et 14-partiti, plerumque in specie una 5--6-partiti, in speciebus aliis ca. 9-partiti, typice grandes, pedicellis quam 1 cm. longioribus. Species typica, Sabatia dodecandra (L.) B.S.P. (Chironia dodecandra L.)

islands of the West Indies.

S. calycina, I feel certain, has very little in common with the species of subsection Campanulatae with which it has been formerly associated by Blake (1915) and Fernald (1950). Its proper relationship is more aptly shown by grouping it with the rhizomatose, pluripetalous species of the dodecandra-alliance. The strongly pronounced tendency for this species to possess flower parts more numerous than five, the large, often foliose calyx lobes, the conspicuous, elongate rhizome, the broad leaves and the broadly campanulate calyx-tube are features of all or most of the Dodecandrae and are present in none of the species with which S. calycina has formerly been allied. If we may use as a criterion of relationship the mistakes made in determination of herbarium material, we find additional evidence for, in the past, S. calycina has been more often confused with the southern representatives of S. dodecandra than with the specimens of the very different Campanulatae. Rafinesque was the first to point out the relationship of this species with the pluripetalous species as he placed it within his subgenus Plurimaria.

The first formal division of the genus was made by Rafinesque (1830, p.76). He then wrote that those "species which have seven to twelve stamens, a seven to twelve parted corolla and calyx, such as S. calycosa, S. chloroides, S. coriacea, S. flexuosa, S. gentianoides approximate to the genus Chlora, and ought to form a peculiar subgenus at least, which I call Plurimaria." Species from both sections

as treated in this paper or in both subgenera of Blake's treatment were originally included in this subgenus. Later Rafinesque (1837) employed this name in an entirely new sense to designate a gentianaceous genus of the Old World.

Pleienta Raf. has been purposely avoided in spite of its being the name most commonly applied to the group. Since this name was superfluous when published, it becomes unavailable for transfer to any other rank. Blake reduced Rafinesque's name to sectional rank and this was followed by Fernald (1950). Typification of Pleienta is no problem for Rafinesque stated "type the Chl. dodecandra L." Chlora dodecandra (L.)L. rests upon Chironia dodecandra which in turn was based upon "Gentiana floribus duodecimpetalis" of Gronovius. Since Adanson (1763) characterized his new genus Sabatia as having a 12-parted calyx and corolla and referred only to the previously mentioned citation from Gronovius' "Flora Virginica", it is clear that the only species that had to be retained in Sabatia was the very one which Rafinesque made the type of his new genus, Pleienta. Such a name is illegitimate having been nomenclatorally superfluous when published since the proposed genus included the type of a previously published genus (Art. 60). Another of the Rules (Art. 51) informs us that upon the subdivision of a genus into genera the original name must be retained with that element of the genus containing the type. There can be no doubt as to the illegitimacy of the generic name Pleienta.

> Art. 69. In cases forseen in Art. 60-68 the name of epithet to be rejected is replaced by the oldest legitimate name, or (in a combination) by the oldest legitimate epithet which will be, in the new position, in accordance with the Rules. If none exists, a new name or epithet must be chosen. Where a new epithet is required, an author may, if he wishes, adopt an epithet previously given to the group in an illegitimate combination, if there is no obstacle to its employment in the new position or sense.

The quoted Article makes provisions for both names and epithets. The regulations applying to each of them are somewhat different. Extracting that which is applicable to names, we find that "in cases forseen in Art. 60-68 the name ...to be rejected is replaced by the oldest legitimate name....If none exists, a new name...must be chosen." Blake (1915) required a name for the group of species including S. dodecandra and he chose an illegitimate generic name and transferred it to sectional rank.

> Art. 16. Each group with a given circumscription, position and rank can bear only one valid name[3], the earliest that is in accordance with the Rules of Nomenclature.
>
> [3]...In subdivisions of genera the valid name is the earliest name published with the same rank provided that this name and its combination with the generic name are in conformity with the Rules of Nomenclature.

Certainly Pleienta Raf. was never "in conformity with the Rules of Nomenclature." It is therefore invalid as the base of a subgeneric name. It might be pointed out that Rafinesque was following his own rules of procedure as outlined in "Flora Telluriana," which corresponded to much current practice before and after his time. His nineteenth article

stated that "if a Genus is to be divided, the old name must be left to the majority or best known species."

KEY TO THE SPECIES

A. Calyx and corolla lobes 5--6-parted or rarely up to 7; corolla lobes (0.6)0.7--1.3(1.5) cm. long; cauline leaves spatulate, tapering into a much-narrowed, sometimes almost petiolate, base. . . . . 12. S. calycina

A. Calyx and corolla lobes 7--13-parted, usually 9--12 in number, corolla lobes (1.2)1.6--2.4(3.5) cm. long; cauline leaves elliptic, lanceolate, or linear, the median and upper at least not strongly tapering into an almost petiolate base. . .

B. Upper cauline leaves less than the diameter of the stem or nearly so, very narrowly linear, contrasting strongly with the broadly spatulate, rosulate, basal leaves; leaves thick and succulent, often drying somewhat rugose; the larger roots succulent, calyx lobes strongly subulate, often succulent and even semicircular in cross-section. . . 15. S. bartramii

B. Upper cauline leaves considerably wider than the diameter of the stem, lanceolate, elliptic, or linear; basal leaves often absent, when present linear to lanceolate, and not strongly contrasting with the lower cauline leaves; leaves drying smooth

and usually thin in texture; roots fibrous, non-succulent, calyx lobes linear, thin and flattened in cross-section.

C. Calyx lobes hyaline-margined; plants strongly stoloniferous; primary branches very often opposite; terminal flower short pedicellate, usually considerably exceeded by the first internode of the lateral branches arising at the same node. . . . . 14. S. kennedyana

C. Calyx lobes not hyaline-margined; stolcns usually lacking, if present neither numerous or strongly developed; primary branches usually alternate; terminal flower typically long pedicellate, usually about equalling or exceeding the first internode of lateral branch arising at the same node. . . . . 15. S. dodecandra

12. Sabatia calycina (Lam.) A. Heller

Gentiana calycina Lam., Encyc. 2:638. 1788.

Chironia dichotoma Walt., Fl. Car. 93. 1788.

Chironia calycosa Michx., Fl. Bor.-Am. 1: 147. 1803.

Sabbatia calycosa (Michx.) Pursh ex Sims, Curtis's Bot. Mag. pl. 1600. 1813.

Sabbatia gracilis var. cubensis Griseb., Mem. Am. Acad. II. 521. 1862.

Sabbatia dichotoma (Walt.) Trelease ex Branner & Coville, Ann. Rept. Geol. Surv. Ark. 1888. 4: 204. 1891.

Sabbatia calycina (Lam.) Heller, Bull. Torrey Club 21: 24. 1894.

Sabbatia cubensis (Griseb.) Urb., Symb. Ant. 8: 536. 1921.

Perennial herb (but apparently also flowering the first year) (8)15--40(50) cm. high, from a slender to thick rhizome (1)2--4(10) cm. long, 1--3 mm. in diameter. Stems usually solitary, or but few, or sometimes several and clustered, erect, rigid, smooth above or but very slightly ridged, hollow at least below, (1)2--3(4.5) mm. in diameter. Branches usually restricted to the upper half or third of the stem but may arise from nearly throughout the entire length, generally alternate but very commonly opposite even above along the main stem, ascendent or more typically divaricate, further branching also strongly divergent, thus the plant typically presents a strikingly geniculate aspect, usually restricted to the second or third order, usually less than 20 cm. long, bearing but few nodes. Root system of several to numerous slender, fibrous roots arising from the rhizome or from the base of the stem. Leaves thin, drying very thinly membranous and hence venation rather conspicuous although only the midvein even slightly elevated beneath. Basal rosette lacking and the lower cauline leaves not conspicuously differentiated in shape from the

median or upper leaves and usually the reduction in size is gradual and slight. Leaves ascending or more often strongly spreading, elliptical to broadly spatulate, mostly obtuse but not unusually acute, tapering into a conspicuous, much-narrowed or even petiolate base, (1.5)2.5--6(10) cm. long, (4)10--18(20) mm. wide. Inflorescence of usually reduced, 1--2-flowered cymules; the flowers appearing loosely arranged and even solitary on slender, rigid, inconspicuously 5--7 angled, (1)3--5(6) cm. long pedicels. Calyx tube thin, smooth or with veins but very slightly elevated, somewhat scarious or translucent, shallowly crateriform to broadly campanulate, (1.5)2--4(5) mm. long. Calyx lobes oblanceolate to spatulate, or rarely linear, often of equal size, usually foliaceous, apparently enlarging after pollination, acute to obtuse, thin, membranous, (8)10--25(32) mm. long, (1)1.5--6(8) mm. wide. Corolla tube cylindrical, (3)4--5(6) mm. long, 2--3 times as long as the calyx tube, white. Corolla lobes equalling the calyx lobes in number, typically 5--6-parted, but occasionally as many as 7, often exceeded in length by the calyx lobes which are sometimes as much as twice as long, but not uncommonly equalling or even exceeding the calyx lobes by 1--2 mm., oblong to oblong-spatulate, oblanceolate or elliptic, obtuse or acute, (6)7--13(15) mm. long, (2)3--5(6) mm. wide, white or more commonly pale rose to pink gradually giving way to white in the area above the triangular, pointed, yellow patch at the base of the lobe. Filaments pale-yellow, 2--3 mm. long; anthers bright-yellow, slender 2.5--3.5 mm. long. Style

1--2 mm. long; stigmatic branches 4--6 mm. long. Capsule almost globose or very broadly cylindrical, 6--10 mm. high, 5--8 mm. in diameter.

Type locality: "Cette plante croit a la Louisiane." Type: the original description states that its author saw it in the herbarium of Jussieu. A photograph seen in the collection of the Gray Herbarium, reputedly the type, was of a specimen in Lamarck's herbarium.

DISTRIBUTION: Ditches, riverbanks and swampy hardwoods from southeastern Virginia south along the Coastal Plain throughout most of Florida and westward into eastern Texas. Also known from eastern Cuba and the Cordillera Central of Hispaniola.

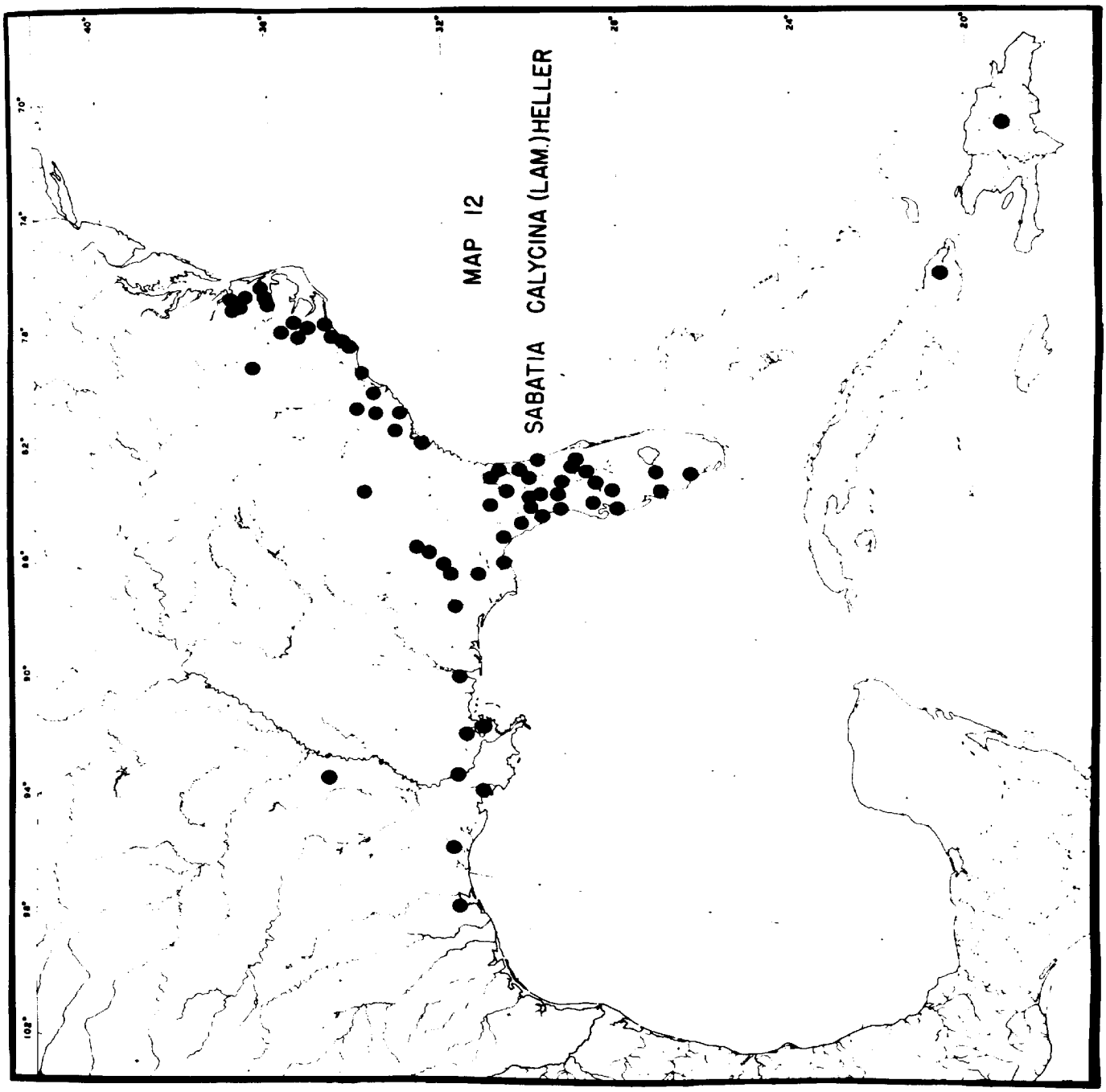
SPECIMENS EXAMINED:

VIRGINIA: Isle of Wight Co., Zune, Fernald & Long 6349 (GH, PENN); Nansemond Co., near Suffolk, Kearney 1726 (US); Southampton Co., about Franklin, Heller 1114 (GH, MO, NY, PENN, US); Sussex Co., west of Lumberton, Fernald & Long 14386 (GH, MO, TENN).

NORTH CAROLINA: Bertie Co., near Edenhouse Point, Correll 1938 (DUKE); Brunswick Co., just west of Wilmington, Wilbur 2894 (MICH); Chowan Co., 1.5 miles east of Edenton, L. F. & Fannie Randolph 659 (CU, GH); Craven Co., near Vanceboro, Alexander 28 July 1923 (NCU); Jones Co., 0.25 mi. n. of Trenton, Fox & Whitfield 1812 (NCS); Lenoir Co., near Kinston, Biltmore Herb. 3306b (US); Nash Co., 2 miles south of Nashville, Blomquist 13277 (DUKE); New Hanover Co.,

MAP 12

Distribution of *Sabatia calycina* (Lam.) Heller


MAP 12
SABATIA CALYCINA (LAM.) HELLER

near Wilmington, Biltmore Herb. 3306c (NY, US); Onslow Co., 4.5 miles s. of Jacksonville, Fox & Boyce 3718 (MICH, NCS); Pender Co., n. of Castle Hayne, Fox & Boyce 3773 (MICH, NCS); Perquimans Co., along river at Hartford, Bartley & Pontius 495 (NY); Pitt Co., west of Grimesland, Wiegand & Manning 2560 (CU, GH).

SOUTH CAROLINA: Beaufort Co., Bluffton, Mellichamp July 1879 (NY); Berkeley Co., 10 miles northeast of Moncks Corner, Godfrey & Tryon 872 (GH, NY, US); Charleston Co., near Charleston, Stewart 10 June 1865 (F); Dorchester Co., along the Ashley River, Correll 5378 (DUKE, NA); Georgetown Co., 1.5 miles west of Andrews, Godfrey & Tryon 555 (DUKE, F, MO, NY, TENN, US); Horry Co., Myrtle Beach, Coker 29 July 1946 (NCU, NY); Williamsburg Co., south of Kingstree, Wiegand & Manning 2562 (CU, GH).

GEORGIA: Baker Co., in western portion of county, Eyles 7185 (DUKE, GH); Dougherty Co., vicinity of Albany, Pollard & Maxon 532 (NY, US); Early Co., about 4 miles southeast of Blakely, Harper 1910 (F, GH, MO, NY, US); Jefferson Co., without exact locality, Hopkins 21 July 1897 (NY); Lee Co., southwest of Byne Crossroads, Thorne & Muenscher 8448 (CU).

FLORIDA: Alachua Co., River Sink, Murrill 21 May 1939 (MO, US); Citrus Co., Red Level, Arnold 24 June 1941 (FLAS); Collier Co., Royal Palm Hammock, Small, Mosier & DeWinkeler 10940 (US); Columbia Co., without exact locality,

Hitchcock 1898 (F, MO); Dixie Co., 0.75 miles from Hines, Arnold 26 Aug. 1937 (FLAS); Duval Co., near Jacksonville, Curtiss 4373 (F, MO, NY, US); Gadsen Co., Chattahoochee, Mowry 1 Sept. 1927 (FLAS); Gilchirst Co., Hart Springs, West & Arnold 21 June 1939 (FLAS); Hardee Co., near Ona Kirk 27 May 1948 (FLAS); Hendry Co., 4 miles south of La Belle, Deam 60705 (DUKE); Hillsborough Co., n. of Knights, Hood 3605 (FLAS); Holmes Co., near Ponce de Leon, Macfarlane (PENN); Lake Co., Eustis, Nash 2063 (GH, MICH, MO, MT, NY, US); Lee Co., vicinity of Fort Meyers, Standley 52566 (US); Levy Co., Rosewood, Garber (BRU, F, NY, US, YU); Manatee Co., Bradenton, Cuthbert 17 June 1923 (FLAS); Marion Co., Orange Springs Landing, West & Arnold 16 Sept. 1941 (FLAS); Nassau Co., e. of Callahan, Hood 4450 (FLAS); Osceola Co., s. of Kissimmee, Hood 3563 (FLAS); Orange Co., 7 mi. se. of Fort Christmas, O'Neill 25 June 1925 (FLAS, US); Polk Co., Bartow, McFarlin 5929 (MICH); Putnam Co., Palatka, Biltmore Herb. 3306a (US); St. Johns Co., near Tocoi, Curtiss 2230 (CU, F, FLAS, GH, MO, NY, SMU, US, YU); Seminole Co., Oviedo, Eaton 1035 (F) Sumter Co., near Rutland, West & Arnold 8 Nov. 1946 (FLAS); Taylor Co., near Perry, Palmer 17 May 1925 (MO); Union Co., Worthington Springs, Klebert & West 79 (FLAS); Volusia Co., Ormond, Fuller 2 Apr. 1904 (GH); Wakulla Co., St. Marks, Ruges July 1843 (NY).

ALABAMA: Mobile Co., Magazine Point, Dougan 19 June 1914 (MO).

LOUISIANA: Calcasieu Parish, vicinity of Lake Charles, Allison 324 (NY, US); East Baton Rouge Parish, near Baton Rouge, Joor 22 May 1874 (F); Orleans Parish, New Orleans, Drummond 222 (GH, K); St. Mary Parish, near Morgan City, Brown 6547 (GH); St. Tammany Parish, near Madisonville, Joor 4 May 1888 (NO); West Carroll Parish, without exact locality, Mosely 7 July 1901 (US).

TEXAS: Harris Co., Houston, Hall 510 (BRU, F, GH, NO, NY, US).

CUBA. ORIENTE PROVINCE: Monte Verde, Shafer 8719 (NY, US); in Cuba Orientali, Wright 412 1856-57 TYPE of S. gracilis var. cubensis (F, GH, MO, NY).

HAITI: DOMINICAN REPUBLIC: Cordillera Central, prov. de la Vega, Constanza, in Cienaga de los Hoyos, Ekman 13919 (GH, MO, NY, US); prope Farabacoa, Fuertes June 1912 (GH); prope Constanza, Turckheim 3368 (GH, MO, NY, US); Cordillera Central, prov. de. Azua, Valle del Yanque, Ekman 13700 (NY).

This wide-ranging species is known from southeastern Virginia to eastern Texas along the outer margin of the Coastal Plain and nearly throughout peninsular Florida. It is known as well from eastern Cuba and the Cordillera Central of Hispaniola (Santo Domingo). In the West Indies it has often been called S. gracilis var. cubensis or S. cubensis. However, in spite of the geographical isolation and the difference in physiographic provinces, there has

not been pointed out previously, nor have I been able to detect from herbarium specimens, any character that distinguishes the West Indian specimens from those of the wide-ranging species of the South Atlantic and Gulf Coastal Plain. The original publication of the insular representatives in a varietal status with the very different S. gracilis, which is a later synonym of S. campanulata, by Grisebach, is especially surprising in view of that author's monographic treatment of the family (1839) and his further elaboration in the Prodromus (1845). Grisebach's varietal name was first treated as a synonym of S. calycina (then referred to as S. calycosa) by Gray (1878) and this still seems to be the only defensible stand to take in view of the lack of any known morphological differences. Urban did not discuss the evidence, if any, that caused him to decide upon specific status.

It should perhaps be stressed that in the United States this species is restricted to the southern Coastal Plain, and for the most part to the outer portion of that physiographic province. In contrast the known stations in the two West Indian islands from which this species is known are in mountainous swamps between 1800 and 4500 feet (660--1500 meters). Its distribution would suggest that it has achieved its present continental range by spreading from peninsular Florida both northward to southeastern Virginia and westward, again remaining close to the coast, to eastern Texas.

Lamarck's publication doubtless has priority over that of Walter as the portion of the former's work in which Gentiana calycina appears is dated April, 1788. Fraser, who carried Walter's Flora back with him and arranged for its publication at his own expense, stated (1789, p. 5) that "after having resided in South Carolina and Georgia nineteen months, I returned to England in the month of March 1788...." This would seem to make certain that it was at least several months after the appearance of Lamarck's name before Walter's Flora could have been published.

13. Sabatia dodecandra (L.) B.S.P.

Chironia dodecandra L., Sp. Pl. 190. 1753.

Chlora dodecandra (L.) L., Syst. Nat. ed. 12. 2: 267. 1767.

Sabbatia dodecandra (L.) B.S.P., Prel. Cat. N. Y. 36. 1888.

Perennial herb (10)30--70(100) cm. high, arising from a slender to robust, often somewhat branched rhizome 4--10(15) cm. long, 2--4 mm. in diameter. Stems erect, solitary or several arising in a cluster, erect, terete, and smooth or somewhat angular and slightly ridged, hollow, (1)2--3(4) mm. in diameter. Branches usually restricted to the upper third or half of the stem, typically alternate, or more rarely, on unusually robust plants, the primary sometimes opposite; ascendent to rather strongly spreading, forming an angle of from 30--70 degrees with the stem, 5--15(20) cm. long, rigid. Root system of

slender, definitely non-fleshy, fibrous roots 5--10 cm. long and generally considerably less than 1 mm. in diameter. Occasionally, especially in the South, with one to few, slender, superficial rhizomes, or more rarely stolons, 2--10 cm. long, 1--2 mm. in diameter bearing small rosettes of few to numerous, thin, slender, oblanceolate, obtuse to acute leaves, 1.5--4 cm. lang. Basal rosettes absent from the base of the aerial stem, the lower cauline leaves neither densely clustered nor strongly contrasting in either size or shape from those borne several nodes higher up on the stem. Cauline leaves spreading to ascendent, non-succulent, in texture drying from thin and membranous to even somewhat thick and chartaceous, smooth, not rugose, with 1--2 pair of usually inconspicuous veins paralleling the midvein which is typically elevated beneath, only gradually reduced above, in length ranging from twice exceeded by the internodes to 3--4 (or more) times surpassed by them, lanceolate, linear, elliptic, or oblong, acute to obtuse, clasping to merely sessile, (1.5)2.5--4(7) cm. long, (4)5--12(20) mm. wide; the lowermost sometimes narrowly spatulate with long tapering almost petiolate base. Inflorescence almost invariably of 1--several, reduced, 1--2-flowered cymules but rarely complete with three flowers; the flowers loosely arranged and thus appearing solitary on erect, rigid, slightly angled pedicels (1)3--6(11) cm. long and about 1 mm. in diameter. Calyx tube crateriform, somewhat turbinate or campanulate, with nerves typically somewhat elevated, (1.5)2--3(4) mm. long,

usually green but sometimes somewhat straw-colored. Calyx lobes thin, flat, drying smooth, linear, marrowly oblanceolate or even spatulate, ranging from rather inconspicuous to large and somewhat foliaceous, acute, (0.4)0.8--1.8(2) cm. long, one-fifth as long to slightly exceeding the corolla in length, 1--2.5 mm. wide. Corolla tube (4)5--7(8) mm. long, usually 2--4 times the length of the calyx tube. Corolla lobes (7)9--12(13) in number, elliptic, oblanceolate, or oblong, acute to obtuse, (1.2)1.6--2.4(3) cm. long, (3)5--8(10) mm. wide, usually not overlapping each other when fully expanded, deep rose-purple, rose-pink, pink, or more rarely white, with oblong to somewhat triangular yellow patch at base of lobe, the patch sharply 3-lobed or even irregularly toothed, usually bordered by thin red line except in albinos. Anthers slender, 3--5 mm. long. Stigmatic lobes slender, 5--9 mm. long; style 3--5 mm. long. Capsule cylindrical, 6--10 mm. high, 4--6 mm. in diameter.

KEY TO THE VARIETIES

a. Internodes usually exceeding the leaf in length, commonly 1.5 to 3 times longer than the leaf; plants usually of brackish habitats, coastal from Connecticut to South Carolina (and perhaps locally to Florida). . . . . 13a. S. dodecandra var. dodecandra

a. Internodes usually equalled in length by the leaf or nearly so, commonly less than the leaf in length and very rarely

exceeded by it as much as 1.5 times; plants on river banks, ditch and stream margins, inland from South Carolina to Louisiana. .

. . . . . 13b. S. dodecandra var. foliosa

13a. Sabatia dodecandra (L.) B.S.P. var. dodecandra

Chironia dodecandra L., Sp. Pl. 190. 1753.

Chlora dodecandra (L.) L., Syst. Nat. ed. 12. 2: 267: 1767.

Chironia chloroides Michx., Fl. Bor.-Am. 1: 147. 1803, illegitimate as it was merely a substitute name.

Sabbatia chloroides (Michx.) Pursh, Fl. Am. Sept. 1: 138. 1814.

Sabbatia dodecandra (L.) B.S.P. Prel. Cat. N. Y. 36. 1888.

Pleienta dodecandra (L.) Raf. ex B. D. Jackson, Ind. Kew. 2: 561. 1894.

Internodes usually exceeding the leaf in length, commonly 1.5--3 times longer.

Type locality: "in Virginia." Type: Clayton 120 (British Museum); photograph of type seen in collection of Gray Herbarium.

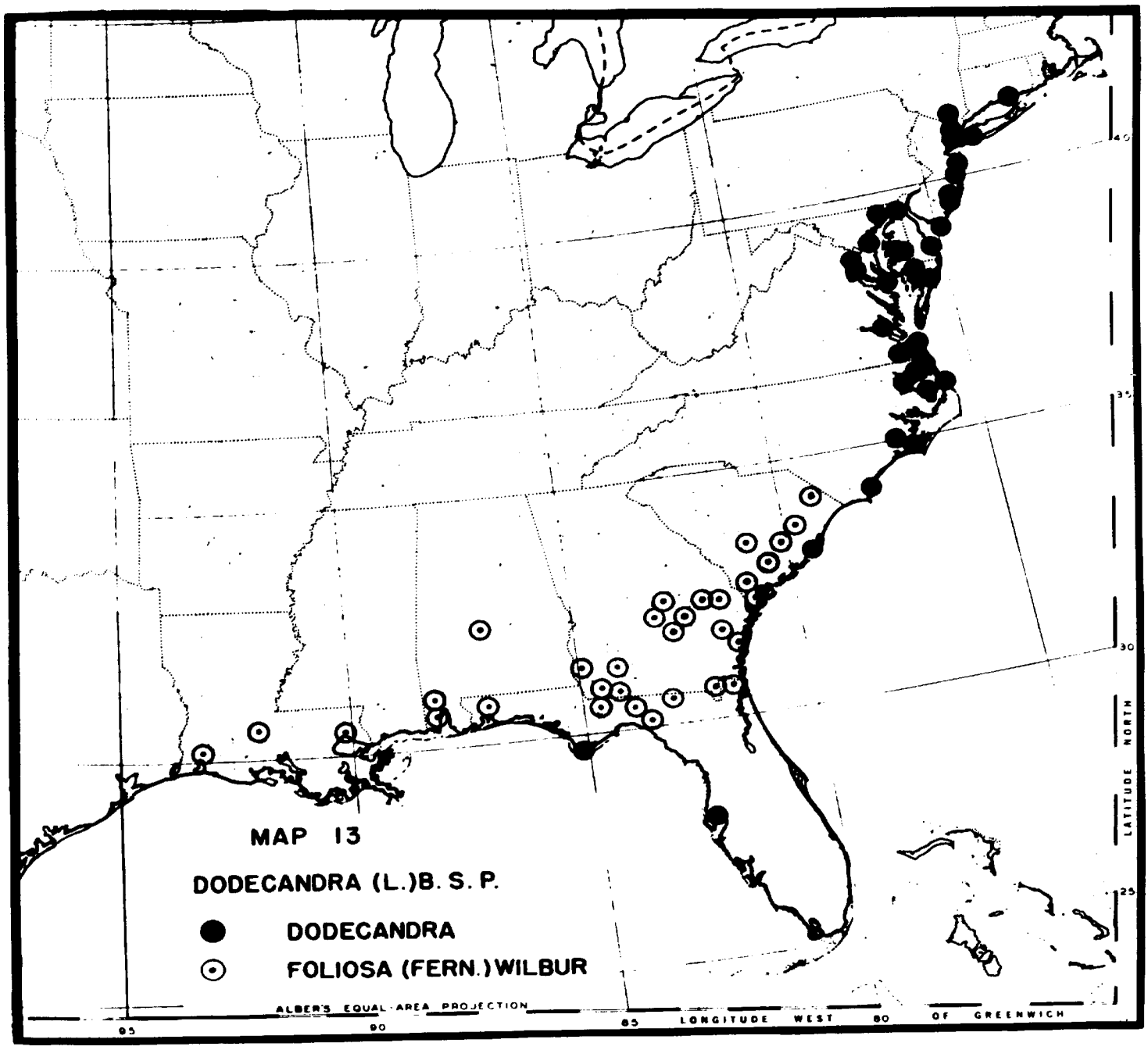
DISTRIBUTION. Salt or brackish marshes from Connecticut south along coast to South Carolina and perhaps locally to Florida.

MAP 13

Distribution of *Sabatia dodecandra* (L.) B.S.P.

● var. *dodecandra*

⊙ var. *foliosa* (Fern.) Wilbur


MAP 13
DODECANDRA (L.)B. S. P.
DODECANDRA
FOLIOSA (FERN.)WILBUR
ALBER'S EQUAL-AREA PROJECTION
95
90
85
LONGITUDE WEST
80
OF GREENWICH
40
35
30
25
LATITUDE NORTH

SPECIMENS EXAMINED:

CONNECTICUT: Middlesex Co., Saybrook, Thompson 20 Aug. 1891 (NY).

NEW YORK: Rockland Co., Iona Island, Muenscher & Curtis 5939 (CU); County unknown, Long Island, White Mills, Poggenburg Aug. 1886 (GH).

NEW JERSEY: Atlantic Co., Port Republic, Long 10486 (GH); Bergen Co., Hackensack marshes, Eaton Sept. 1860 (YU); Burlington Co., New Gretna, Chrysler 30 Aug. 1926 (CU, RUT); Cape May Co., First of Fishing Creek Bogs, Walker 1653 (NA, US); Hudson Co., Granton, Sickle 1 Aug. 1894 (US); Monmouth Co., Avon-by-the-Sea, Kaufman 25 Aug. 1904 (YU); Ocean Co., e. of Silverton, Long 38148 (PENN).

DELAWARE: Sussex Co., s. of Rehoboth Beach, Hood 2378 (FLAS).

MARYLAND: Anne Arundel Co., Furnance Branch, Plitt 5 Aug. 1902 (GH); Caroline Co., between Choptank River and Bethlehem, Killip 7279 (US); Cecil Co., ca. 1.5 mi. s. of Elkton, Long 57046 (GH); Charles Co., Stump Neck, Turpin 474 (US); Harford Co., 0.25 mi. north of Bush River Station, Shull 344 (GH, MO, NY, US); St. Marys Co., St. Mary's River 3.7 mi. from St. Mary, Walker 3888 (US); Somerset Co., Kings Creek, Holmes 24 July 1890 (US); Talbot Co., 5.5 mi. se. by s. of Easton, Earle 3075 (PENN, WVA); Wicomico Co., Wicomico River near Salisbury, Smith 302 (MT, NY); Worchester Co., Stockton, Rusby Aug. 1889 (NY).

VIRGINIA: Fairfax Co., near mouth of Occoquan Creek, Ulke 1 Aug. 1910 (US); James City Co., about five miles from Toano, Menzel 193 (GH); Nansemond Co., south of Reid's Ferry, Fernald and Long 13423 (GH); Norfolk Co., near Northwest, Fernald & Long 13997 (GA, GH, MO); Princess Anne Co., Cape Henry, Egler & Ryan 40-183 (NY).

NORTH CAROLINA: Carteret Co., between Core Creek and Adam's Creek, Hill 171 (DUKE); Chowan Co., near Edenton, Godfrey 5346 (GH, US); Craven Co., 2 miles southwest of James City, L. F. & Fannie Randolph 862 (CU, GH); Currituck Co., marshes at Sligo, Godfrey 5279 (DUKE, GH, US); Dare Co., Kill Devil Hills, Fox 144 (MICH, NCS); New Hanover Co., Carolina Beach, Biltmore Herb. 3305c (GH, MICH MO, NCU, NY, PENN, US); Pasquotank Co., Elizabeth City, Kearney 1996 (US); Tyrrell Co., Fort Landing, Radford 4622 (NCU).

SOUTH CAROLINA: Charleston Co., north of McClellanville, Godfrey & Tryon 722 (DUKE, F, GH, MICH, MO, NY PENN, TENN, US).

FLORIDA: Franklin Co., St. Vincent Island, McAtee 1835A (US); Hillsborough Co., Tampa Bay, Leavenworth (GH, NY). The material upon which these Florida records are based is rather unsatisfactory for identification but the specimens seem to belong to the more northern population.

13 b. Sabatia dodecandra (L.) B.S.P. var. foliosa (Fern.) comb. nov.

Sabbatia foliosa Fern. Bot. Gaz. 33: 155. 1902.

Sabbatia Harperi Small, Fl. SE. U. S. 928. 1903.

Sabatia obtusata Blake, Rhodora 17: 54. pl. 112. 1915.

Internodes usually equalled or exceeded by the leaves, commonly the leaves as much as 1.5 times as long as the internodes.

Type locality: "Muddy banks of the Blackwater River, near Milton, Florida." Cotype and lectotype: Curtiss 5928 (GH).

DISTRIBUTION: River banks, ditches, stream and pond margins inland from South Carolina into northern Florida and westward into Louisiana.

SPECIMENS EXAMINED:

SOUTH CAROLINA: Beaufort Co., Bluffton, Mellichamp 1887 (US); Berkeley Co., 10 miles northeast of Moncks Corner, Godfrey & Tryon 876 (DUKE, F, GH, MO, NY, PENN, TENN, US); Charleston Co., 17 miles due w. of Charleston, Duncan 5802 (GA); Colleton Co., Cottageville, Hunt 1648 (CHARL, MICH); Jasper Co., Ridgeland, Mohr 14 Nov. 1893 (US); Marion Co., east of Nichols, Wiegand & Manning 2561 (CU, GH); Orangeburg Co., North Edisto River, Smith 9 Aug. 1884 (F, GH, MO, US); Williamsburg Co., 6 miles south of Kingstree, Godfrey & Tryon 369 (DUKE, F, GH, MICH, MO, NY, PENN, TENN, US).

GEORGIA: Bullock Co., swamp of Big Lott's Creek, Harper 964 COTYPE of S. Harperi (GH, MO, NY, US); Candler Co., 6 miles ne. of Metter, Pyron & McVaugh 713 (GA, US); Charlton Co., Traders Hill, Wright 879 (CU); Decatur Co., between Forest Falls and Bainbridge, Harper 1196 COTYPE of S. Harperi (GH, MO, NY, US); Dodge Co., between Copeland and Rhine, Harper 1876 (F, GH, MO, NY, US); Early Co., about 2 miles east of Restler, Harper 1912 (F, GH, MO, NY, US); Grady Co., about 4 miles west of Whigham, Wise 30 June 1940 (FLAS); Jenkins Co., about 3 miles west of Millen, Pyron & McVaugh 968 (GA, US); Laurens Co., 12 miles south of Wrightsville and 6 west of Adrian, Pyron & McVaugh 3056 (GA, NA); Long Co., 3 miles southwest of Ludowici, Wilbur & Webster 2756 (MICH); McIntosh Co., Darien, Wiegand & Manning 2564 (CU); Mitchell Co., 12 miles northeast of Camilla, Thorne 5784 (CU); Montgomery Co., north of Mt. Vernon, Harper 1866 (F, GH, MO, NY, US); Telfair Co., near Lumber City, Biltmore Herb. 3305d TYPE-number of S. obtusata (US).

FLORIDA: Gadsen Co., southwest of Havana, Small, Small & DeWinkeler 11387 (NY, US); Jefferson Co., 2 miles northwest of Lamont, Webster & Wilbur 3631 (MICH); Madison Co., 1 miles west of Greenville, Wiegand & Manning 2565 (CU, GH); Nassau Co., Boulogne, Hume & West 14 July 1933 (FLAS); Santa Rosa Co., near Milton, Curtiss 5928 (CU, FLAS, GH TYPE of S. foliosa, KSC, MO, NCU, NY, SMU, US); Taylor Co., 14 miles northwest of Perry, Webster & Wilbur 3635 (MICH).

ALABAMA: Mobile Co., Mobile, Harvey (US); Dallas Co., Selma, Biltmore Herb. 3305a (US); Washington Co., 2 miles south of Wagarville, Webster & Wilbur 3496 (MICH).

LOUISIANA: Calcasieu Parish, Lake Charles, Tracy 3453 (F); St. Landry Parish, Opelousas, Carpenter (GH); St. Tammany Parish, vicinity of Covington, Arsene 11706 (US).

As may be surmised from the synonymy there is considerable variation within the species. Some indication of this may be deduced from the fact that in the past fifty years three species have been proposed. The variation is so great that with only a few sheets upon which to base their conclusions, it is not at all surprising that the various authors were convinced of the distinctness of the entities that they were publishing. After all the available herbarium material was assembled, it was found that these specimens, which looked so distinctive in the small study sets, are submerged in a welter of collections that bridge the presumed gap between the proposed species by various combinations of the supposed diagnostic characteristics. The several hundred specimens of this species that I have examined from nearly one hundred stations extending from Connecticut to Louisiana are quite diverse and at the same time it is all but impossible to define any of the various tendencies that have attracted the interest of botanists in the past. It is now quite certain that extensive field work will be necessary before anything but a tentative treatment can be proposed. It has been only in the last half

century that any progress has been made in recognizing that Linnaeus' original binomial, based upon the specimens of Clayton from Virginia, was far from sufficient to cover the small but diverse group of species that previously had been placed under one specific name. The inadequacy of many of the specimens, is still a problem that hinders understanding. Variation is conspicuous in nearly all parts of the plant and only one character appeared to be useful in the recognition of taxonomic units appearing to possess any geographic continuity.

After the belated recognition of the specific status of the entity formerly called S. decandra in 1900, the next species to be segregated from the all-inclusive S. dodecandra (= S. chloroides) was S. foliosa Fern. in 1902. What eventually became the cotype of this species was sent to Gray Herbarium by the collector, A. H. Curtiss, who afterwards distributed the duplicates as S. chloroides according to the determination by Fernald. Fernald became more impressed with the features of the southern plant after observing similar variation in specimens collected by J. Donnell Smith in South Carolina. He described it as a species especially emphasizing (1) the more stoloniferous habit, (2) leaves equalling the internodes, (3) foliaceous calyx lobes. The calyx lobes in both the numerous duplicates collected by Curtiss and those of Smith are certainly large, ranging in size from one-half or more commonly three-quarters the length of the corolla lobes to even longer. This character has proved most variable and the variation

is so great within the same colony and even on the same plant that it is of little absolute importance. For example, the length of the calyx lobes of large series of specimens collected (Wilbur & Webster #3583) along the eastern bank of the Blackwater River just across from Milton, Florida, the locality from which one of the cotypes was collected, ranges rather uniformly between one-fifth and three-quarters the length of the corolla lobes.

In the next year Small (1903) proposed another species based largely upon two collections from central Georgia which he called S. harperi, in honor of the original collector. The supposed distinguishing characters were calyx lobes less than half the length of the corolla and features of the leaf which have proved highly inconstant. Small restricted the range of S. foliosa to Florida and Alabama, which would have excluded one of the cotypes. S. harperi was said to range from South Carolina to Florida and west to Louisiana. In the previous month Harper, in his account of the very same collections, referred to them as S. foliosa upon the authority of Fernald who had examined them. Harper pointed out at that time that "the two species (i.e., S. foliosa and S. dodecandra) are very closely related differing perhaps in habitat as much as in any other way" in that "S. dodecandra seems to be mostly a maritime plant, while the usual home of S. foliosa is in creek and river swamps." Harper apparently was not aware of Small's proposed species at the time. Fernald had informed him also that S. dodecandra was not represented

in the Gray Herbarium from south of North Carolina and this restricted range was presented in the Seventh Edition of Gray's Manual.

Blake (1915) concluded that S. foliosa and S. harperi were conspecific. At the same time he proposed a new species, S. obtusata, from central Georgia. The distinctive features were said to be oblong leaves with rounded apices and non-clasping bases which nearly equalled the internodes. He emphasized that S. foliosa (including S. harperi) had "considerably longer calyx lobes" and the sketch accompanying the description of S. obtusata showing part of the type indicates that the calyx lobes extend barely one-third the length of the corolla. I feel confident that none of the differences that were pointed out in proposing this entity are of distinctive importance since they are but minor variations which are well within the range of variability of the southern population. Several of these features appear within the individual sheets taken from one colony. The diagnostic importance of clasping versus sessile leaves has been overemphasized in the past. Robustly developed plants throughout the range of the species may possess clasping or semi-clasping leaves. In the last edition of the Manual (1950), the range and habitat of S. dodecandra was stated as "saline brackish or rarely fresh marshes and meadows, Fla. to La., n. on or near Coastal Plain to s. Ct." In all of the many sheets that Fernald annotated, mostly in 1916, there is only one from south of North Carolina that he considered

at that earlier date to be S. dodecandra and that, a very fragmentary specimen of Buckley from Alabama, seems quite inadequate for satisfactory determination. In spite of Fernald later admitting a more extensive range for S. dodecandra, it is not to be supposed that he had abandoned the attempt to distinguish the entities, for he implies that fresh-water habitats are the exception for the species. This is anything but true in the South.

I am convinced that it is impossible to maintain S. dodecandra, S. foliosa, S. harperi, and S. obtusata as four distinct entities, regardless of rank. The extensive range of morphological variation which is correlated ecologically and perhaps even geographically seems, however, more than the normal fluctuation to be expected within even a wide-ranging species.

In general the material examined from stations ranging from Connecticut to just north of Charleston, South Carolina is characterized by having the internodes from half again to twice or more as long as the leaves and this variety seems for the most part to be rather closely restricted to brackish habitats or at least seldom gets very far from the coast. The variety that occurs from South Carolina to Florida and westward to Louisiana is characterized by having shorter internodes which rarely exceed one and a half times the length of the leaves and more often than not are equalled or exceeded by them. Its habitat is inland among river banks and borders of ditches and streams. Most of the specimens available to me have

been easily separable by this morphological criterion and by several additional tendencies that are little more tangible than the "certain indescribable grace" of E. L. Greene. A few exceptions were encountered. Rather unsatisfactory specimens were seen from St. Vincent Island and Tampa Bay, Florida which have been tentatively determined as S. dodecandra, the only specimens so identified by me from south of South Carolina. From the southeastern corner of this last-mentioned state three collections are available and they too leave considerable to be desired in providing for positive determination. There are few complete or even modern collections known from Alabama, none at all from Mississippi, and very few from Louisiana.

In spite of the obvious need for intensive field work and an accumulation of mass collections from the entire range of the species before this group will be satisfactorily understood, it is believed that the treatment suggested here will serve as a more natural and at the same time more useful arrangement. This should prove a better point of departure for the necessary research than has previously been available.

14. Sabatia kennedyana Fern.

Sabatia Kennedyana Fern., Rhodora 18: 150. fig. 98c. 1916.

Perennial herb (15)30--65(80) cm. high, arising from slender, easily broken rhizome about 2--3 mm. in diameter and up to 12 cm. long. Stems usually solitary or

occasionally 2 to several arising together, erect, stiffly rigid, terete, smooth, ridgeless throughout, hollow below, 2--4(6) mm. in diameter. Branches typically restricted to the upper third or half of the stem, the primary typically opposite, at least in well-developed plants, additional ramifications, when present, mostly alternate; usually rather strongly ascendent forming an angle of about 20--40(50) degrees with the stem, generally 5--15(30) cm. long, slender, rigid, futher branching also typically geniculate. Root system a dense mass of non-fleshy, very slender, white to straw-colored roots 5--10 cm. long, and 1 mm. or less in diameter. Typically with few to several or occasionally with numerous slender, decumbent stolons initiated as superficial rhizomes 2--8(12) cm. long, 1--2 mm. in diameter, bearing few to several slender roots and at the tip a rosette of numerous, ascendent to erect, usually very narrowly linear or oblanceolate leaves 10--15 times as long as broad, 2--6(15) cm. long, 3--8(15) mm. wide, acute to acuminate, strongly long-tapering to the nearly petiolate base. Leaves thin, non-succulent, drying brittle, smooth, thinly chartaceous in texture, venation obscure except for the midvein which is somewhat elevated beneath; the basal leaves, when present, and the lower cauline very similar in size and shape to those of the stolon-borne rosettes, the cauline strongly ascendent and only gradually reduced above, stems hence appearing almost equally leafy throughout, typically lanceolate or narrowly linear, weakly clasping or sessile, acute to acuminate,

slightly callose-tipped, (1.5)3--5(10) cm. long, (2)4--10(16) mm. wide, usually about (5)7--12(15) times as long as wide, ranging from about (0.5)2--4(5) times as long as the internodes. Inflorescence dichasial and composed of complete to reduced cymules; the terminal flower typically shortly pedicellate and usually greatly exceeded by the first node of the lateral branches. Flowers borne on erect, slender, smooth pedicels (0.5)1--5(7) cm. long and about 1 mm. in diameter. Calyx tube crateriform or shallowly campanulate, thin, smooth or rarely with a few nerves slightly elevated (2)3--5(4.5) mm. long, green to almost straw-colored. Calyx lobes linear, (5)6--10(18) mm. long, 0.5--1.5 mm. wide, thin, very flat in cross-section, acute, slightly hyaline-margined, strongly ascendent, green in color. Corolla-tube cylindrical, 5--8 mm. long, 2--3 times as long or about 2--4 mm. longer than the calyx tube, pale-yellow without, darker within. Corolla lobes (7)9--12 in number, (12)18--24(26) mm. long, (4)7--10(13) mm. wide, obovate-spatulate, cuneate-obovate, or more rarely oblong, tapering gradually to broad 3--5 mm. base, broadly obtuse or rarely somewhat emarginate, usually overlapping, rose-pink, pink, or rarely white, with an often 3-pointed, oblong, yellow patch usually about 4--7 mm. long, except in white flowers this area bordered by a dull-red to reddish-brown line. Filaments slender, pale-yellow, (2)4--6(7) mm. long; anthers linear, slender, bright-yellow, 3--6 mm. long; Style 2--6 mm. long; stigmatic lobes slender, (4)5--7(9) mm. long. Ovary rather conspicuously half-exserted from the corolla tube. Capsule broadly

cylindrical, 7--11 mm. long, 4--7 mm. in diameter.

Type locality: "shore of Wequawket Pond, Centreville, Barnstable Co., Massachusetts." Type: E. F. Williams s. n. (GH!)

DISTRIBUTION: Sandy and peaty margins of ponds and streams in southern Nova Scotia, eastern Massachusetts, Rhode Island, southeastern North Carolina and northeastern South Carolina.

SPECIMENS EXAMINED:

NOVA SCOTIA: Yarmouth Co., Gravelton, Fernald & Long 22266 (F, GH, MO, NY, PENN, YU, US).

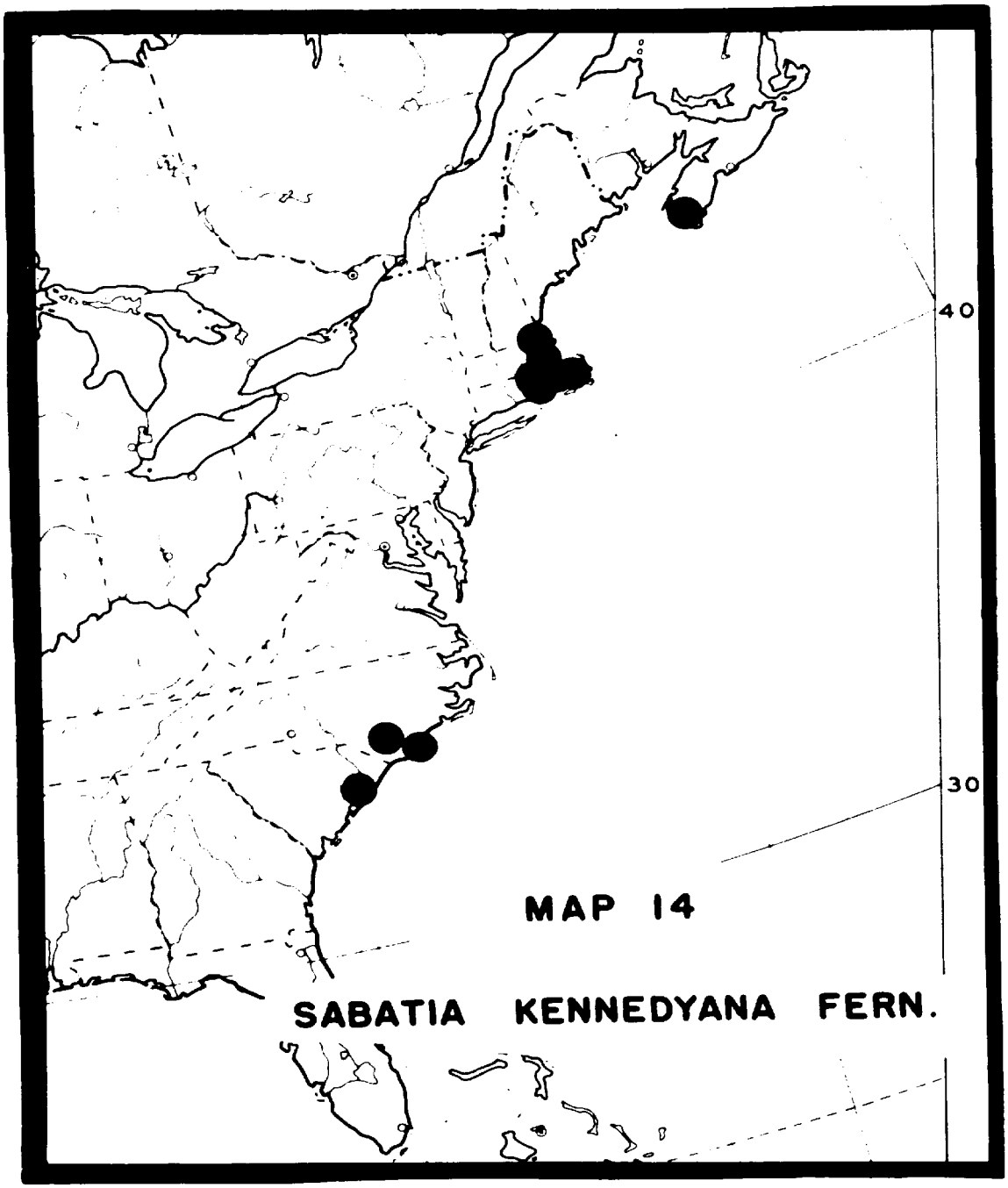
MASSACHUSETTS: Barnstable Co., Harwich, Fernald Pl. Ex. Gr. 387 (CU, DUKE, GA, GH, F, MICH, MO, MT, NCS, NO, NY PENN, OKL, TENN, UARK, WIS, WVA, YU); Bristol Co., Dartmouth, Sturtevant 26 July 1889 (CU, F, MO); Essex Co. Newburyport, Chamberlain June 1899 (NY); Norfolk Co., Weymouth, Seymour 4373 (DUKE, WIS); Plymouth Co., in inundatis ad Plymouth, Oakes (GH, NY, US, YU).

RHODE ISLAND: Kent Co., Warwich, Bailey 27 July 1883 (US); Washington Co., South Kingstown, Congdon (MO, NY, YU).

NORTH CAROLINA: Columbus Co., between Ash and Old Dock just west of the Waccamaw River, Wilbur 2892 (MICH); New Hanover Co., Wilmington, McCarthy 1885 (GH, NCU, US).

MAP 14

Distribution of *Sabatia kennedyana* Fern.


40
30
MAP 14
SABATIA KENNEDYANA FERN.

SOUTH CAROLINA: Horry Co., near Ocean Drive, Schallert 12 June 1933 (NY).

S. kennedyana, recognized only in 1916 as being distinct from the widespread S. dodecandra, is a rather easily identifiable entity with as distinctive morphological features as any of the four species within the subsection. It is distinguished by a combination of several strong tendencies rather than by one or even a few strong and constant features. These characteristics are: stems almost perfectly smooth and in well-developed specimens the primary branches typically opposite; the terminal flowers, usually short-pedicellate, typically being much exceeded by the first internode of the lateral branches; leaves thin, drying thinly chartaceous, brittle smooth; corolla lobes broadest near the tip, more or less obovate-spatulate, calyx lobes linear and hyaline margined, thin and flat in cross-section; calyx tube broad, thin, unribbed. Some of these characteristics are shared by other species but the combination is unique. In addition the frequency of the stolon borne rosettes and their development in size is much greater in this species than in any of the others within the subsection. Therefore, in spite of the late date of recognition of the distinctness of this species, it appears to be a very strongly characterized entity and not merely the result of too diligent a study of too few specimens.

When originally described, the plant was known

only from Rhode Island and Massachusetts. Four years later Fernald discovered it in Nova Scotia where it is apparently fairly common in Yarmouth County on the southern side of that peninsula. An even greater range extension for this species into southeastern North Carolina and northeastern South Carolina can now be reported. Drs. H. L. Blomquist and R. K. Godfrey, and I made a large collection of what proves to be this species along the sandy bank of the Waccamaw River in Columbus County, North Carolina in the summer of 1951. Upon examination of these very complete specimens, it was possible to recognize that several other collections from the same general area which had previously been uncritically passed over as merely abnormal S. dodecandra were in reality this species which I had not expected to see south of the fresh-water ponds of southern New England. Disjuncts between the eastern Carolinas or southeastern Virginia and Delaware, New Jersey or New England are of course quite numerous but examples matching that of S. kennedyana are certainly much less common. One species with a somewhat similar distribution as shown by existing records is Scirpus longii Fern. This sedge is at present known from one station in eastern North Carolina, again from New Jersey to Massachusetts, and finally reappears in western Nova Scotia. Fernald (Rhodora 45:55. 1943.) wrote that this species of Scirpus "has shown itself to be an old Coastal Plain type which, like so many other species, became isolated in Nova Scotia before the late Tertiary or Early Pleistocene submergence of the continental shelf."

The range of this species, at least in its southern reaches is scarcely known at present and it is hoped that the present account will stimulate further collecting in that fascinating area whose store of botanical surprises seems never to be exhausted. The earliest collections of this species from the South that I have seen were made by Gerald McCarthy in 1885 near Wilmington, N. C., and identified as S. gentianoides. This species was in part the basis for the record of Elliott's species in the check list of New Hanover County published by Wood and McCarthy (Journ. Elisha Mitchell Sci. Soc. 3: 115. 1886.), although true S. gentianoides, a very different species, was also collected from that area.

The possibility that the name S. kennedyana may be synonymous with Chironia decandra Walter is discussed under S. bartramii and need not be presented here. Walter's name had best be treated, it is believed, as a nomen dubium.

15. Sabatia bartramii sp. nov.[1]

Sabbatia chloroides var. coriacea Ell., Sk. Bot. S.C. & Ga. 1: 286. 1817. Type seen. (CHARL!)

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[1]Sabatia bartramii sp. nov. Perennes a rhizomatibus. Folia crassa, succulentia, saepissime siccitate plus minusve rugosa; radicalia rosulata, spatulata vel oblanceolata; caulinia lanceolata vel linearia, ultima supreme plerumque angustiora quam caulis diameter. Flores plerumque 10 -- 12 partiti, calycis lobis setaceis vel subulatis, succulentibus, saepe semiteretibus. Specimen typicum in savanna prope Pensacolam, in Florida, legerunt Webster et Wilbur, sub numero 3577, et in Herb. Universitatis Michiganensis conservatum.

Sabbatia chloroides var. flexuosa Ell., l.c., excluding synonym. Type seen. (CHARL!)

? Sabbatia chloroides var. erecta Ell., l.c. There is no specimen representing this variety in Elliott's herbarium. The original description is practically a word for word translation of Walter's description of Chironia decandra, which he cited in synonymy.

Pleienta flexuosa [Ell.] Raf., Fl. Tell. 3:30. 1837, without basic synonym or description.

? Sabatia chloroides β stricta Griseb., Gen. et. Sp. Gent. 125. 1839. The description is again almost word-for-word the same as that of Chironia decandra Walt., which he cited in synonymy.

Sabbatia dodecandra spp. stricta (Griseb.) Mohr, Bull. Torrey Club 24: 26. 1897.

Sabbatia decandra in the sense of R. Harper, Bull. Torrey Club 27: 432. 1900, probably not Walt., Fl. Car. 95. 1788.

Perennial herb (25)50--80(100) cm. high, arising from slender to thick rhizome 4--6 or more cm. long, 3--5 mm. in diameter. Stems almost invariably solitary, erect and rather rigid, terete, more or less smooth and ridgeless or but finely nerved, hollow, 2--5 mm. in diameter. Branches usually restricted to the upper third of the stem, typically alternate but occasionally opposite at one or two of the primary nodes; ascendent usually forming an

angle with the stem of from 30--45 degrees, usually 10--20(40) cm. long, typically unbranched and bearing but one flower, or if branched seldom with more than 2 flowers. Root system of numerous, clustered, fleshy roots 5--12 cm. long, 1--2 mm. in diameter bearing but few, slender, fibrous lateral roots. Leaf texture thick, succulent, drying rather thickly chartaceous or rarely the lowermost become thinly membranous upon drying, venation obscure excepting the midvein which is often elevated beneath, the apices often callous-mucronate. Leaves strongly dimorphic in appearance with an abrupt transition from the basal to the cauline; the basal strongly spreading, conspicuously rosulate, oblanceolate, somewhat oblong, or more typically broadly spatulate, strongly but gradually long-tapering to the almost petiolate base, obtuse or rarely acute, (2.5)4--8.5(13) cm. long, (4)12--17(22) mm. wide; cauline strongly ascendent and becoming even closely appressed, the lower lanceolate but gradually, or even abruptly, reduced to linear or even very narrowly linear above, where their width is often equal to, or less than, the diameter of the stem, (1.5)2.5--5(6.5) cm. long, (1)2--8(15) mm. wide. Inflorescence of reduced cymules of commonly one and rarely more than two flowers borne on slender, rigid, finely ridged pedicels (3)4--8(12) cm. long, terminal or arranged on usually undivided lateral branches bearing one or more rarely of several nodes. Calyx tube ridgeless, crateriform to campanulate, usually broadly so, occasionally especially in smaller flowers somewhat turbinate, (2)3--

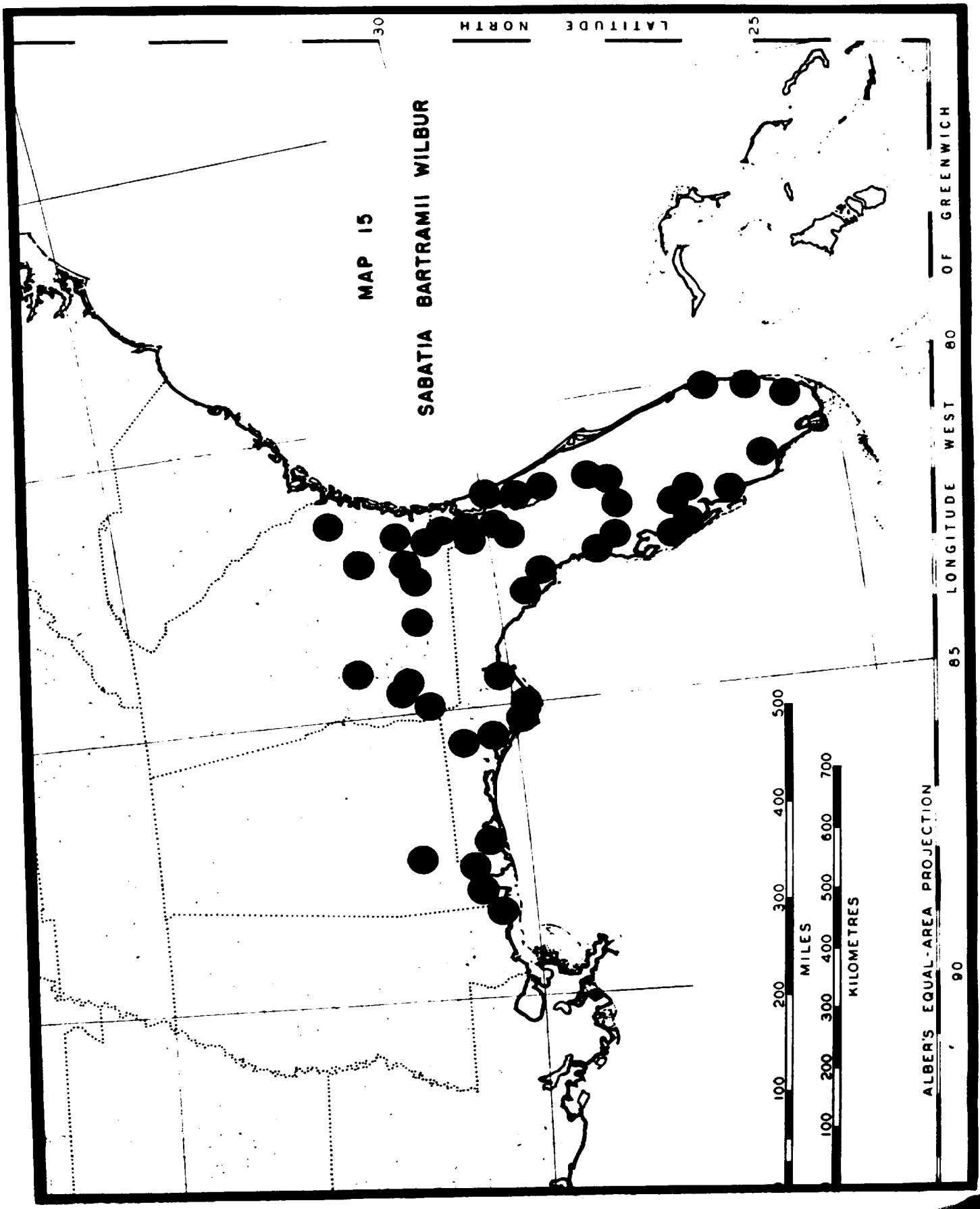
4(8) mm. long, usually straw-colored in strong contrast to the darkly chlorophyllose lobes. Calyx lobes typically strongly subulate, (4)8-12(20) mm. long, often rather succulent, drying thin and flat or commonly somewhat rugose-thickened, ellipsoidal below to nearly round above in cross-section, often somewhat revolute, erect, strongly ascendent or but weakly spreading, dark green in color. Corolla tube cylindrical, (5)6--8(9) mm. long, usually about 2-- 3 times as long as the calyx tube, apparently pale-yellow externally and darker within. Corolla lobes (8)10--12(13) in number, (16)22--32(35) mm. long, (5)7--10(12) mm. wide, obovate-spatulate or rarely oblong to elliptic, usually broadly obtuse, deep rose-magenta, rose-pink, rose, or rarely white, with an irregularly but slightly toothed, yellow, oblong patch at the base of the lobe 3--5 mm. long, usually bordered by a dark red line. Filaments slender, (3)4--6(7) mm. long, pale-yellow; anthers linear, slender, golden-yellow, 5--7 mm. long. Style 4--6 mm. long; stigmatic lobes slender 7--10 mm. long. Capsule ovoid, 6--8 mm. long, 4--6 mm. in diameter.

Type locality: savanna about 9 miles west of Pensacola, Escambia Co;, Florida. Type: Webster & Wilbur 3577 (MICH).

DISTRIBUTION: Savannas or low pine-barrens from southern Georgia and Alabama to southeastern Mississippi and nearly throughout Florida.

MAP 15

Distribution of *Sabatia bartramii* Wilbur


MAP 15
SABATIA BARTRAMII WILBUR
LATITUDE NORTH
30
25
LONGITUDE WEST OF GREENWICH
85
80
MILES
100
200
300
400
500
KILOMETRES
100
200
300
400
500
600
700
ALBER'S EQUAL-AREA PROJECTION
90

SPECIMENS EXAMINED.

GEORGIA: Appling Co., near Baxley, Biltmore Herb. 14965b (US); Baker Co., near Bethany, Eyles 7247 (CU, GH); Brantley Co., 3 miles east of Nahunta, Wilbur & Webster 2746 (MICH); Bryan Co., about 2 miles west of Pembroke, McKay 14 Aug. 1930 (MICH); Calhoun Co., 5 miles east of Arlington, Thorne 5444 (CU, GA); Charlton Co., near Saddlebag Pond, Wright 871 (CU); Clinch Co., 4 miles east of Homerville, Eyles 6331 (GA); Cook Co., 0.5 mile se. of Sparks, Wilbur & Webster 2691 (MICH); Miller Co., in sw. corner of county just n. of Donalsonville, Duncan 6755 (MICH); Sumter Co., without exact locality, Harper 461 (F, GH, MO, NY, US); Ware Co., 5 miles se. of Waycross, Wilbur & Webster 2737 (MICH).

FLORIDA: Alachua Co., Waldo, West 14 June 1927 (FLAS); Baker Co., 9 miles south of Macclenny, West & Arnold 12 July 1946 (FLAS); Bay Co., 8 miles north of Lynn Haven, Wilbur & Webster 3623 (MICH); Broward Co., Ft. Lauderdale, Eaton 798 (F, GH); Clay Co., 2 miles north of Goldhead Branch State Park, West & Arnold 15 July 1947 (FLAS); Collier Co., near Fort Shackleford, Small 8340 (DUKE, GH, NY, TENN, US); Dade Co., Humbugus Prairie, Small, Mosier & Small 6885 (NY); DeSoto Co., without exact locality, Schallert 29 July 1940 (UARK); Dixie Co., south of Oldtown, West & Arnold 11 Aug. 1937 (FLAS); Duval Co., Baldwin, Nash 2250 (F, GH, MICH, MO, NY, US); Escambia Co., 9 miles west of Pensacola, Webster & Wilbur 3577

(MICH); Flagler Co., near Andalusia, Arnold 25 June 1942 (FLAS); Franklin Co., near Apalachicola, Biltmore Herb. Dist. of Chapman Herb. 3305b (GH, NY, US); Gulf Co., 7 miles north of Port St. Joe, Small & West 8 Aug. 1935 (FLAS); Hardee Co., near Limestone, Kirk 8 July 1942 (FLAS); Hernando Co., Bayport, Jones 76 (CU, US); Lee Co., about 8 miles southeast of Fort Meyers, Standley 447 (F, GH, MO, US); Levy Co., 14 miles southeast of Chiefland, Webster & Wilbur 3640 (MICH); Manatee Co., Manatee River, Rugel 155 (MO, US); Nassau Co., 0.5 mile south of Callahan, Wright 873a (CU); Orange Co., without exact locality, Fredholm 5374 (GH, US); Osceola Co., Kissimmee, Eaton 1062 (F, GH); Palm Beach Co., 1 mile north of Lake Park, Hannon 12 June 1948 (FLAS); Pasco Co., s. of Denham, Hood 3572 (FLAS); Polk Co., Polk City, McFarlin 5979 (MICH, TEX); St. Johns Co., St. Augustine, Garber July 1876 (US); Sarasota Co., Myakka, Barrett 45 (US); Volusia Co., near Seville, Curtiss 6843 (CU, GH, KSC, MO, NA, NY, US); Wakulla Co., 1.5 miles south of Sopchoppy, Webster & Wilbur 3629 (MICH); Washington Co., 4 miles west of Chipley, Webster & Wilbur 3611 (MICH).

ALABAMA: Baldwin Co., 1 miles north of Stapleton, Webster & Wilbur 3522 (M CH); Mobile Co., Crichton, Sawada 18 Aug. 1933 (NY); Monroe Co., Claiborne, Blanton 53 (GH, MT, NO, NY, OKLA, US).

MISSISSIPPI: Jackson Co., about 4 miles east of Moss Point, Webster & Wilbur 3466 (MICH).

This very striking and strongly characterized

species probably the most distinctive of any of those belonging to the subsection, is recognizable at once by the strongly subulate calyx lobes, which are thickened and semicircular in cross-section; the usually somewhat fleshy leaves, the obtuse, spatulate basal leaves contrasting strongly with the abruptly reduced cauline leaves, the uppermost of which are very narrowly linear being little broader than the diameter of the stem. These features are in very strong contrast with the thin, flat, linear to foliaceous calyx lobes of the other southern species of the same area whose upper cauline leaves are always at least several times the diameter of the stem. Also the basal rosette is either absent or poorly developed, or, if present, the cauline leaves are only very gradually reduced. The rather high percentage of misidentification of specimens of this species in the past, or the inclusion of material of other species under this name, came about from the key differences as presented by Small in both his Flora (1903) and Manual (1933) which have, as often as not, been misleading. The distinction first utilized by him was that of the length of the corolla lobes. In this species, however, the length overlaps very considerably with the other species of the Dodecandrae commonly collected in the area. In the last-mentioned work he added another key distinction, that of the shape of the corolla lobes, which also was poorly chosen for that characteristic is also extremely variable.

There is considerable uncertainty regarding the

name to be applied to this species. S. decandra, the name that has designated it for more than fifty years rests upon a binomial published in Thomas Walter's "Flora Caroliniana" (1788). Walter's Flora provides very brief diagnoses of the six species of what was then called Chironia. Linnean binomials were applied to three of the entities and new ones provided for the remaining species. The characterization of them all is so brief that one is able to place them only tentatively even if one is quite familiar with the genus. Blake stated (Rhodora 17:129. 1915) that there are now but seven specimens of Sabatia in Walter's herbarium, located at the British Museum.

A print has been obtained of the page bearing all the chironias still in Walter's collection from the negative made by Dr. Bernice Schubert, through the courtesy of the director of the Gray Herbarium, Dr. Reed C. Rollins. Although the photograph was not such that absolute determination of all seven existing specimens in the genus could be made, it was sufficient to prove that at present there is no material representing the species that we have been calling S. decandra.

The three specimens located at the bottom of the page all appear to by S. calycina (Lam.) Heller. Lamarck's name has two years' priority over Walter's own Chironia dichotoma, of which these plants represent the type. The specimen in the center of the page is S. dodecandra var. foliosa as the internodes are equalled or exceeded by the leaves. Not only are its cauline leaves many times

broader than the stem but the photograph clearly shows that the calyx lobes are of the flat and broader type, characteristic of S. dodecandra. These four fragments belonging to two species are the only specimens belonging to subsection Dodecandrae, the group to which the species passing as S. decandra also belongs. The two fragmentary specimens located in the upper right-hand corner of the page are S. difformis, of which Walter's Chironia lanceolata is a synonym. The remaining specimen, although the most completely preserved of any on that page, is the most difficult to identify from the photograph. It is an annual belonging to subsection Campanulatae with an elliptical, rather large leaves and is probably S. stellaris. The perennial S. campanulata was the only species of that subsection included in Walter's work. This interpretation is the best that I can make of the seven fragments, basing my conclusion completely upon the photograph.

In 1900 Harper, recognizing that this southern population was specifically distinct from the more widespread species with which it had formerly been considered a variety, transferred Walter's Chironia decandra to Sabatia. It is now apparent that the range of the species to which this name has been applied lies entirely south of South Carolina and for that reason it is questionable whether it is conspecific with Walter's C. decandra. I have seen no specimens from north of the Ogeechee River in Georgia which is nearly one hundred and fifty miles from the area in which Walter lived and collected. The last

paragraph of the preface of the Flora is of interest since it delimits the area covered by the work. The following translation has been kindly provided by Prof. H. H. Bartlett.

> In this work I have included more than a thousand plants, which is so remarkable that it might seem unbelievable, if it were not known that nearly all were collected from an area not larger than that to be circumscribed by a line twice duplicated of fifty thousand paces. Moreover, many have eluded observation, as experience teaches daily. The grasses and plants belonging to the class Cryptogamae remain generally untouched. In addition, many trees, shrubs and herbs are omitted of which the fructification has not yet been obtained.

This quotation clearly indicates that the material upon which the Flora was based was for the most part collected within less than thirty miles of Walter's plantation on the Santee River, fifty miles north-northwest of Charleston, South Carolina. John Fraser (1789) in a very rare publication, provides the only other information known to me concerning the source of the material treated in the Flora. Fraser wrote (1789, p. 4):

> The botanical description of many of the plants which I found, are contained in Flora Caroliniana with the author of which, the late Mr. Walter, I became acquainted soon after my arrival in Carolina. He had collected when I went into that country, plants which afforded him six hundred and forty descriptions. I increased his work, by the specimens I produced to him, to one thousand and sixty, amongst which are upwards of two hundred new species, and thirty new genera; of all which as well as the other plants in the Flora, I have now dried specimens in my possession, and many valuable living plants. Many of the most valuable specimens and living plants I collected are still remaining in my hands, undescribed.

Fraser spent a little over a year and a half on this trip

in the states of South Carolina and Georgia in which time he states that he collected over thirty thousand specimens.

It is not definitely stated by Fraser that the four hundred and twenty species that he added to the Flora came from the area outlined by Walter. It is certain, however that may be, that there is at the present time no specimen representing the species that of late has been passing as S. decandra among the material remaining in Walter's herbarium and furthermore there are no stations of that species known further north than approximately one hundred fifty miles to the south of Walter's home. This distance may no doubt be somewhat lessened by further collecting, but it is problematical whether the present picture in regards to range will ever be seriously altered.

I am not aware of any attempt having been made to determine which of the species in Walter's Flora must have been collected in parts of South Carolina or even Georgia, far removed from that author's home on the Santee. Frasera caroliniensis appeared in the Flora and was name in honor of John Fraser who doubtless collected it on his "journey to the Cherokee Nation in search of new plants." Card, (Ann. Mo. Bot. Grad. 18:245-282. 1931) in his monograph of Frasera, cites no specimens from South Carolina but it is very likely that it occurs in the western part of the state as it is known from the adjacent areas of North Carolina and Georgia. It is not known from even the Piedmont of those states and its range appears to be from the mountains westward and northward. Here, then, is at least one plant

included in the Flora that probably reached the eastern limits of its range two hundred miles to the west of Walter's plantation. A complete analysis of the Flora in regard to the distribution of the included species would be of considerable interest and value to those interested in the southeastern flora.

The complete account of Walter's species as originally published is presented below:

decandra 6. flor. decimfidis colore dodecandrae foliis linearibus, caule rigido erecto.

This description, as Harper has said, is to say the least "rather brief" and I am not at all certain as to what either Walter or Fraser had in hand. Harper goes on to say that "there is no other known plant in the southeastern states that answers it exactly, and as his name for the species is cited as a synonym by both Elliott and Grisebach, no hesitation is felt in taking it up here." It is now certain that Walter's description is not sufficient to limit the description to the species to which Harper applied it. Probably the closest that Walter came in presenting the diagnostic features was in mentioning the linear leaves and the stiff erect stem. There are occasionally encountered specimens of S. dodecandra that match the few features mentioned and certainly S. kennedyana which formerly was not known outside of Nova Scotia and southern New England but is now recognized as being also part of the flora of the eastern Carolinas, is often perfectly characterized by those same features. Therefore,

the southern species pointed out by Harper and the more northerly S. kennedyana both fit the meager description of Walter, and it is not impossible that he had merely another form of S. dodecandra. The southern range of S. kennedyana is of interest but as yet has not been accurately determined. This northern species is represented by one collection from near Ocean Drive, Horry Co., S. Carolina and is extremely abundant in at least one spot along the Waccamaw River in North Carolina, a river which eventually joins the Pee Dee before emptying into the sea. It therefore seems safe to predict that it may soon be found commonly along many of the sandy stream and river margins in the general vicinity. Regardless of what range may be established by future intense collecting in that very interesting region, S. kennedyana, whose morphology agrees with Walter's brief description at least as well as with that of the species to which Harper attributed the name, is already known within the general are from which most of the species of "Flora Caroliniana" were collected. Therefore, it seems to me just as probable that Chironia decandra was based upon the species that is now known as Sabatia kennedyana as upon the more southern entity to which that name has been assigned for the past century and a quarter.

We seem than to have three alternatives to choose among in making a decision as to C. decandra.

1. It has not been proved that Walter did not have the southern species that has borne this epithet for so many years. Since it has not been definitely established

that Walter did not have that species, some might counsel for the retention of the name in its present usage until proved untenable.

2. If Walter's species was not what Harper thought it to be, then it is quite possible that it was the species that has been called S. kennedyana. This last-mentioned name dates from 1918 and, if this hypothesis could be proved, S. decandra (Walt.) Harper should be applied to that species.

3. Chironia decandra is an excellent example of a nomen dubium, as its application seems highly uncertain, and it should therefore be rejected (Art. 63. Int. Rules Bot. Nomen.).

Of the three possible paths that might be followed, the last seems to be the most desirable and the only one that places nomenclature in the group upon a firm foundation rather than resting it upon rather shaky conjectures.

This well-known plant, ranging from eastern Mississippi eastward through southern Georgia and southward almost throughout peninsular Florida, is therefore without a name and one must be provided. Instead of elevating any of the varieties which are at least in part synonyms of this species, I thought it best to provide a new name. These varietal names, based for the most part upon the synonymy of C. decandra, are inappropriate as there is in all instances at least some doubt as to the concept of the author proposing them. It seems best to provide this long misunderstood plant with a name with which there can

be no doubt as to typification and which is not dependent upon the interpretation of incomplete descriptions from the past. For that reason the name Sabatia bartramii has been been chosen. William Bartram prepared an unmistakable sketch of the upper portion of this species but some of his statements concerning the plant are indicative of less accuracy in observation. For example, his manuscript concerning the plant states that "the number of Petals are various, from 15 to 20 or 30, but never saw any double flowers." This sketch has been reproduced by Francis Harper (Amer. Phil. Soc. Trans. 33: (2) Plate XXIV). Even the lowest number mentioned by him is more than I can recall seeing either in the field or on any of the specimens that I have examined from the various herbaria. The material from which the plate was drawn was apparently seen in eastern Florida as it is described according to Dr. Francis Harper in "Book I. Est. Florida Plants." It is quite possible that the nomen nudum mentioned by him in in 1791 in his Travels was this same plant. More than sixty miles south of the Altamaha River according to Bartram's own estimate (actually probably not more than half that distance in a straight line) he describes traversing a land of "high open forests of stately pines, flowering plains, and extensive green savannas, chequered with the incarnate Chironia pulcherrima, and Asclepias fragrans perfumed the air whilst they pleased the eye."

II. Section PSEUDOCHIRONIA Griseb.

Subg. Plurimaria Raf., Med. Fl. 2: 76. 1830, in part, not Plurimaria Raf. (as genus), Fl. Tell. 3: 31. 1837.

Pleienta Raf., Fl. Tell. 3:30. 1837, in part.

Sect. Pseudochironia Griseb., Gen. et Sp. Gent. 125. 1839.

Lapithea Griseb., Prodr. 9: 48. 1845.

Subg. Pseudochironia (Griseb.) Blake, Rhodora 17: 56. 1915.

Annuals. Floral parts plurimerous, 7--12-parted. Flowers sessile or very nearly so and borne either solitarily or more typically in compact, capituliform cymules. Anthers about half-twisted laterally even prior to pollen-discharge and never becoming revolute.

TYPE SPECIES: Sabatia gentianoides Ell.

The two species comprising this group are very strongly differentiated from the other eastern American species belonging to the subtribe Erythraeinae with strongly bilobed, linear stigmatic branches. Their distinctive features are such that Grisebach, after first placing the only species known to him in his section Pseudochironia, coordinate with a section for all the other species, finally six years later decided upon generic status calling it Lapithea. Bentham (1873) maintained this group as the genus Lapithea as did Gilg (1895). Small treated it as a genus in all of his work. Blake (1915) discussed the

differences and concluded that "the group is better treated as of subgeneric value." Subgeneric status arrangement still seems to best express the phylogeny and relationship of the group without belittling the distinctive features that so distinguish the two species from all others in the genus. I consider the two groups of species to be of sectional rank.

The two species are both very easily distinguished from the species comprising the rest of the genus and also from each other. S. boykinii, known only from the ancient Appalachian highlands, is believed to be more primitive than the Coastal Plain S. gentianoides which possesses greatly reduced and modified foliage in comparison to that of the supposedly more primitive species.

KEY TO THE SPECIES

A. Basal and cauline leaves not strongly contrasted in either size or shape; cauline leaves oblong, elliptic or rarely weakly lanceolate, usually broader than 1 cm. and never less than 5 mm. wide, five or more times the diameter of the stem in width, less than 5 times as long as wide, calyx lobes linear, erect, their margins parallel for most of their length. . . . . . 16. S. boykinii

A. Leaves strongly dimorphic, the basal strongly contrasting with those of the stem in both size and shape; cauline leaves very narrowly

linear, less than 5 mm. wide, usually equalling or less than the diameter of the stem, 20--60 times longer than broad; calyx lobes subulate, the tips often recurved or reflexed. . . . . 17. S. gentianoides

16. Sabatia boykinii A. Gray

Pleienta capitata Raf., Fl. Tell. 3:30 1837, illegitimate name.

Sabbatia Boykinii A. Gray in Chapm., Fl. S. U. S. 354. 1860.

Sabbatia gentianoides Boykinii A Gray Wood, Am. Bot. & Flor. 266. 1870.

Lapithea Boykinii (A. Gray) Small, Fl. SE. US. 929. 1903.

Sabatia capitata (Raf.) Blake, Rhodora 17: 54. 1915.

Lapithea capitata (Raf.) Small, Man. SE. Fl. 1051. 1933.

Erect annual (15)30--45(70) cm. high; stem 1--4 mm. in diameter, rigid, hollow, more or less terete to slightly 4-angled, smooth or often upon closer examination with few very slightly raised, lines extending between the internodes. Branches usually present except in depauperate plants, either opposite or alternate but in well-developed plants more commonly opposite, often restricted to the upper third of the stem but occasionally branching nearly to the base, varying greatly in length ranging from (1)3--8(30) cm. long, rather strongly ascendent, forming an angle of about 20--40 degrees with

the stem. Root system of several to numberous fibrous roots usually about 3--8 cm. long, the larger somewhat woody and up to 2 mm. in diameter. Leaves, weakly if at all dimorphis, the basal not strongly contrasting with the cauline in either shape or size, thin, not at all succulent, drying thin, smooth and brittly chartaceous, venation rather conspicuous with 3--5 nerves somewhat elevated beneath, the midvein especially so; the basal, when present and well-developed obovate to broadly spatulate, sometimes rosulate, obtuse, tapering to the almost petiolate base, not strikingly contrasted to those above, 2.5--5 cm. long, 1--2 cm. wide; the cauline broadly, or more rarely narrowly, oblong elliptic, or weakly lanceolate, usually about 2--4 times longer than broad, about 5--15 times as wide as the diameter of the stem, weakly ascending, strongly spreading or even somewhat reflexed; (2.5)3.5--5(6.5) cm. long, (7)10--20(25) mm. wide, broadly obtuse or sometimes even acute, typically the base somewhat clasping. Inflorescence cymose, terminating the main stem or the lateral branches. Flowers sessile or very nearly so, borne singly or in few to several (2--5 or very rarely more) flowered compact clusters, each closely associated with 2 subtending oblong to elliptic bracts about 1--2 cm. long. Calyx tube broadly campanulate, 3--6 mm. long, smooth, unnerved, membranous. Calyx lobes linear, 4--10 mm. long, and about 1--2 mm. wide, erect or strongly ascendent, often strikingly unequal, 7--12 in number, about 1--2 times the length of the calyx tube and about half the length of the corolla. Corolla

tube about 5--7 mm. long or about 1--2 mm. longer than the calyx tube, probably pale greenish-yellow. Corolla lobes about 12--25 mm. long, 5--13 mm. wide, elliptical, obovate, or spatulate, acute to more typically rounded-obtuse, pale rose-pink, pink, or rarely white with an unlobed, pale-yellow semicircle at the base about 1--2 mm. high. Filaments slender, (2)3-4 mm. long; anthers stout, slightly twisted laterally even prior to pollen discharge, bright-yellow, (2.5)3--5(6) mm. long. Style 3--5 mm. long; stigmatic branches spatulate, 6--9 mm. long. Capsule apparently ovoid.

Type locality: "Georgia." Type: Dr. Boykin s. n. (NY!)

DISTRIBUTION: Open hardwoods on hillsides and ridges in southwestern North Carolina (?), northeastern Georgia, southeastern Tennessee, and northeastern and central Alabama.

SPECIMENS EXAMINED.

NORTH CAROLINA: County unknown but probably Cherokee Co., "from Cherokee," collector and date unknown (MO).

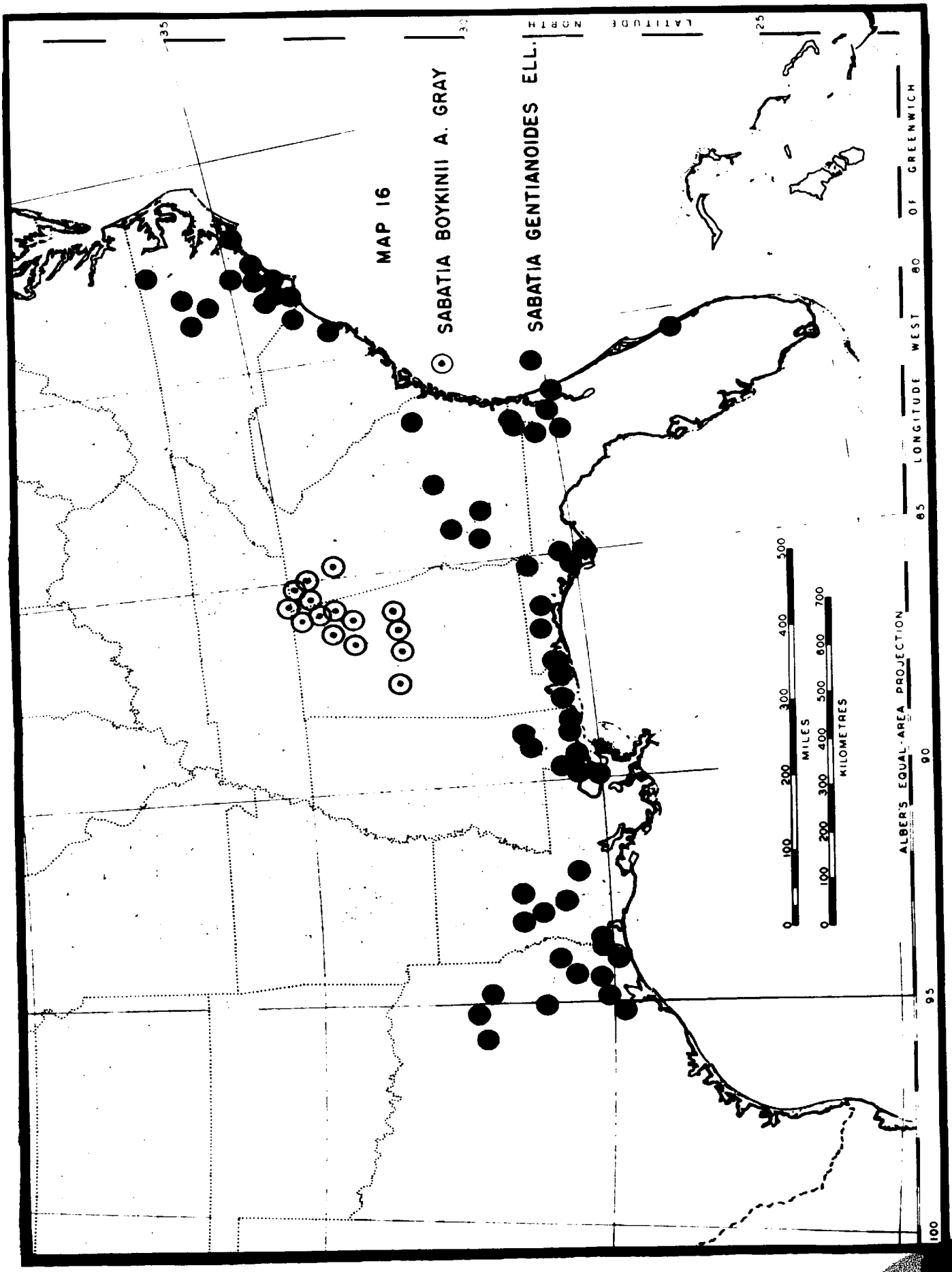
GEORGIA: Bartow Co., 3.8 mi. n. 14° w. of Allatoona Dam, Duncan 8613 (GA); Catoosa Co., Catoosa Springs, Biltmore Herb. 4512b (US); Walker Co., Pigeon Mt., Wilson 172 (NY, US); Whitfield Co., base of Dick's Ridge, Wilson 142 (NY, US); County unknown, Boykin GH, NY--TYPE, US).

MAP 16

Distribution of Section Pseudochironia Griseb.

⊙ Sabatia boykinii A. Gray

● Sabatia gentianoides Ell.


MAP 16
SABATIA BOYKINII A. GRAY
SABATIA GENTIANOIDES ELL.
LATITUDE NORTH
LONGITUDE WEST OF GREENWICH
ALBER'S EQUAL-AREA PROJECTION
MILES
KILOMETRES

TENNESSEE: Marion Co., Cumberland Mts. at Whiteside, White 22 July 1895 (US).

ALABAMA: Blount Co., without exact locality, Rugel Oct. 1843 (NY); Cherokee Co., Lookout Mt., Freeman 11 July 1905 (KSC); Clay Co., Millerville, Pollard & Maxon 173 (NY, US); DeKalb Co., Valley Head, Biltmore Herb. 4512e (US); Etowah Co., near Coosa River, Mohr July 1880 (US); Jackson Co., Eliza, Graves 1191 (MO); Marshall Co., 3.2 miles north of Boaz, Hubricht B1668 (FLAS, MO); Shelby Co. Calera, Everts (NY); Talladega Co., south of Childersburg, Hood 285 (FLAS); Tuscaloosa Co., without exact locality, Smith July (US).

This species, strikingly different from all others, has by far the most restricted range of any in the genus. It is also the only species which is completely limited to the southern Appalachian uplands, a biological reservoir from which spread much of the ancestral flora of eastern North America. This plant has been very little collected due most likely to the slight biological investigation that the area has received. A critical field survey of this plant with the view of determining the exact limits of its range together with careful notes on habitat and associated species should make an interesting study.

Determining the valid name to be applied to this species is not an easy task or one that can be definitely settled at this time. The difficulty is not that the Rules legislated by the 1935 Congress are at all vague, for

they seem most explicit; it is that the most recent Congress has recommended for the consideration of the Editorial Committee a change that would, if accepted, completely alter present legislation. It seems inadvisable therefore to outline the different nomenclatural results that the present Rules and those that may be enacted would effect.

This species was first discovered in the Unaka and Cherokee Mountains along the southern portion of the boundary between North Carolina and Tennessee and was very fully described by Rafinesque in the "Flora Telluriana" (1837). Like most of that author's work, that Flora was not given serious attention and the application of this name was not known for over seventy-five years. The species was first effectively brought to the attention of "reputable botanists" nearly twenty-five years after Rafinesque's description when it was published as S. boykinii in Chapman's Flora (1860) and attributed to Gray. This was based upon material in Torrey's herbarium sent by Dr. Boykin from "middle Georgia." There it was seen by Gray and according to the annotation was apparently intended as a joint publication of Torrey and Gray. It appeared in Chapman's work as mentioned above. The remaining synonymy of this species involves merely various combinations based upon either of these names. The valid name is dependent upon whether the Rules are changed, as apparently favored by the majority voting at the last Congress, or whether they are left as they are at present.

Sabatia capitata (Raf.) Blake is based upon

Pleienta capitata. As has been discussed previously Pleienta was segregated from Sabatia to include the non-pentamerous species and is therefore illegitimate since the only species originally assigned to the last-mentioned genus by its author, Adanson, was the plurimerous Chironia dodecandra. This species was also designated as the type of Pleienta by Rafinesque. Articles 51 and 60 of the 1935 Rules can leave no doubt as to the legitimacy of a generic name formed in such a manner. The last-mentioned article states also that the "publication of an epithet in an illegitimate combination must not be taken into consideration for purposes of priority." Article 45 also states that "for purposes of priority, however, only legitimate names and epithets published in legitimate combinations are taken into consideration." It seems doubly clear then that epithets published under an illegitimate generic name are to be disregarded "for purposes of priority." Article 69 informs us that if there were no legitimate name available for the southern Appalachian endemic, then Blake could, if he had wished, have adopted Rafinesque's illegitimate epithet but, under the Rules adopted under the 1935 and 1950 Congresses, the resultant name would be considered as a new name and not as a new combination. S. boykinii was, however, legitimate and available and no other name was needed. Under the Rules that are still one's only guide in such matters, S. boykinii is the valid name for this species although it has not been in vogue since 1915.

As has been pointed out above, there has been a change recommended by the majority of the Congress for the consideration of the Editorial Committee that would, if adopted, completely reverse the above decision. The most complete account of the proceedings known to me is the transcript published by deWit (Flora Malesiana Bull. 1950: 197-231. 1950.) which bears upon the present problem very decidedly.

> The section adopted the following motion and decided that the Ed. Comm. should consider the advisability of admitting it into the Rules:
>
> "An epithet is not considered illegitimate only because it was originally published under an illegitimate generic name but must be taken into consideration for purposes of priority if the epithet and the resp. combination are in other respects in accordance with the Rules. In the same way, an epithet of a subspecies or a taxon of a lower rank may be legitimate even if originally published under an illegitimate name of the subsequent higher taxon."

It is clear that the acceptance of this change in the Rules would make the epithet published by Rafinesque available for transfer and, as it has many years' priority over Gray's name, the valid name for the species would then be S. capitata.

17. Sabatia gentianoides Ell.

Sabbatia gentianoides Ell., Sk. Bot. S. C. & Ga. 1: 286. 1817.

Pleienta gentianoides [Ell.] Raf., Fl. Tell. 3:30. 1837, without basonym.

Lapithea gentianoides (Ell.) Griseb., Prodr. 9: 48. 1845.

Sabbatia oligophylla Featherman, Rep. Bot. Surv. S. & Cent. La. 72. 1871

Erect annual (15)30--50(65) cm. high; stem 1--3 mm. in diameter, rigid, hollow, more or less terete but with fine and irregular internodal ridges. Very commonly unbranched below the terminal inflorescense; but when branched the branches usually restricted to the upper quarter of the stem, occasionally branched in the lower half, or even more rarely with several stems arising from the base; commonly either opposite or alternate but more typically alternate, usually about 5--8 cm. long or rarely up to 20 cm., strongly ascendent forming an angle of about 20--40 degrees with the stem. Root system of several to numerous slender, fibrous roots 3--8 cm. long and less than 1 mm. in diameter. Leaves thick and somewhat succulent, drying rather thickly chartaceous and rugose, strikingly dimorphic, venation obscure except for the midvein; those of basal rosette wide-spreading, oblong to orbicular-spatulate, typically long-persistent, (1)2--3(3.5) cm. long, (4)8--12 (15) mm. wide, usually about 2--3 times as long as wide, rounded-obtuse, rather strongly tapering to the base and therefore appearing petiolate; the cauline very narrowly linear, 20--60 times longer than broad, width equalling or less than the diameter of the stem, strongly ascendent, and sometimes even appressed especially in the lower portion of the leaf, (15)40--80(100) cm. long, 1--3 mm. wide, acute and slightly callous-tipped, sessile or clasping the stem. Flowers sessile or very nearly so, borne singly at

the principal apex or at that of the lateral branches, or more typically in most robustly developed plants, especially at the apex of the principal axis, in few to several (2--5 or rarely even 7) flowered compact clusters. Each flower closely associated with 2 subtending, narrowly linear bracts, (1) 1.5--4(7) cm. long. Calyx tube broadly campanulate, (3)4--6(8) mm. long, smooth and unnerved, membranous, light green to pale yellowish-green. Calyx lobes conspicuously subulate, (3)5--10(17) mm. long, spreading-ascendent, arching outward especially at the tip, somewhat unequal in size, 7--12 in number 1--2 times as long as the calyx tube, and usually about half or less than half the length of the corolla. Corolla tube 6--10 mm. long, about 1.5--2 times as long as the calyx tube, pale greenish-yellow, cylindrical. Corolla lobes (12)18--24(30) mm. long, (4)6--8(11) mm. wide, elliptical, spatulate to oblanceolate, acute to rounded-obtuse, pink to deep rose with an unlobed greenish-yellow area at the base of the lobe 2--3 mm. high. Anthers stout, slightly twisted laterally even prior to pollen discharge, golden yellow, (3)4--6(7) mm. long; filaments slender, short, often about half as long as the anthers, 1--3 mm. long, pale-yellow. Stigmatic branches spatulate, 4--7 mm. long, 1.5--3 mm. wide. Style 5--8 mm. long. Capsule ovoid, 7--10 mm. high, about 6 mm. wide at the base.

Type locality: "in Bullock Co., Georgia." Type: Abbott s. n. (CHARL!)

DISTRIBUTION: Pinelands and savannas along the Coastal Plain from North Carolina south into Florida and west into eastern Texas.

SPECIMENS EXAMINED:

NORTH CAROLINA: Bladen Co., on Rt. 211, 21 mi. ne. of Columbus Co., line, Fox & Whitford 1867 (NCS); Brunswick Co., 2.5 miles south of Grissettown, Fox & Godfrey 2836 (GH, MICH, NCS, NCU); Carteret Co., Newport, Godfrey 5789 (GH, US); Columbus Co., 1 mi. se. of Delco, Fox & Godfrey 2872 (NCS, SMU); Duplin Co., 8 mi. w. of Richlands, Godfrey 5784 (GH, US); Johnston Co., south of Selma, Dlans 28 July 1933 (NCU); Nash Co., between Bailey and Middlesex, Oosting 35574 (DUKE); New Hanover Co., near Wilmington, Abbe & Spalteholz 3 Aug. 1927 (CU, NCU); Northampton Co., near Jackson, Rhoades Aug. 1935 (GH); Onslow Co., near Folkstone, Alexander 25 July 1923 (NCU); Pender Co., Burgaw, Godfrey 5924 (GH, NCS, US); Wake Co., just w. of Raleigh, Fox 1828 (DUKE, GH, NCS). Also represented (F, NY) by specimens reputedly made from Statesville, Iredell Co. by M. E. Hyams. These and other Coastal Plain plants known only from the Piedmont by her collections are suspected of having been gathered in the Coastal Plain but distributed with printed Statesville labels.

SOUTH CAROLINA: Georgetown Co., 12 miles northwest of Georgetown, Godfrey & Tryon 745 (DUKE, F, GH, MO, NY, TENN, US); Horry Co., 6 miles east of Loris, Wilbur 2902 (MICH).

GEORGIA: Bullock Co., without exact locality, Abbot TYPE of S. gentianoides (CHARL); Calhoun Co., 3 miles east of Cordrays Pond, Thorne 6476 (CU); Charlton Co., 8 miles south of Folkston, Wright 863 (CU); Dodge Co., Eastman, Biltmore Herb. 4509c (NY); Sumter Co., without exact locality, Harper 1121 (GH, MO, NY, US); Worth Co., 3.5 miles west of Sylvester, Thorne 6350 (F, GA, MT, US).

FLORIDA: Baker Co., without exact locality, Curtiss 2233 (CU, F, MO, NY, US, YU); Bradford Co., w. of Starke, Bratley & Murrill 5 July 1940 (FLAS); Clay Co., Doctor's Inlet, West & Arnold 29 June 1939 (DUKE, FLAS, MO, US); Escambia Co., near Ala. state line, Porter 21 July 1938 (FLAS); Franklin Co., near Apalachicola, Biltmore List of the Chapman Herb. 4509a (GH, NY, US); Gulf Co., Wewahitchka, Chapman (MO); Indian River Co., 5 miles north of Vero Beach, Woodson & Schery 126 (MO); Jackson Co., west of Marianna, Porter 21 July 1938 (FLAS); Liberty Co., near Bristol, Arnold 23 July 1940 (FLAS); Nassau Co., Boulogne, Hume & West 14 July 1933 (FLAS); Okaloosa Co., c. 3 miles e. of Crestview, Webster & Wilbur 3589 (MICH); St. Johns Co., near St. Augustine, Garber July 1876 (BRU, F, NY, US, YU); Walton Co., Argyle, Curtiss 6484 (CU, GH, MO, NY, SMU, US).

ALABAMA: Baldwin Co., 8 miles south of Foley, Webster & Wilbur 3532 (MICH); Butler Co., near Bolling, Smith 28 Aug. 1885 (F, MO, US); Mobile Co., about 12 miles southwest of Mobile, Webster & Wilbur 3478 (MICH).

MISSISSIPPI: Forrest Co., about 8 miles southeast of Hattiesburg, Webster & Wilbur 3379 (MICH); Hancock Co., Bay St. Louis, Langlois 12 Sept. 1883 (PENN); Harrison Co., Biloxi, Tracy 7007 (CU, F, GH, MO, US); Jackson Co., 2 miles east of Ocean Springs, Webster & Wilbur 3450 (MICH); Pearl River Co., Picayune, Reed 2 Aug. 1934 (NA); Perry Co., 9 miles north of Beaumont, Webster & Wilbur 3420 (MICH).

LOUISIANA: Allen Parish, Oakdale, Bomhard 22 June 1933 (NO); Calcasieu Parish, 3 miles southwest of Vinton, Webster & Wilbur 3212 (MICH); Grant Parish, 4 miles south of Pollock, Webster & Wilbur 3258 (MICH); Orleans Parish, New Orleans, Carpenter (MO); Natchitoches Parish, about 2 miles south of Kisatchie, D. S. & H. B. Correll 9796 (DUKE); Rapides Parish, Alexandria, Hale (BRU, F); St. Landry Parish, Opelousas, Carpenter (GH, NY); St. Tammany Parish, 1 mile north of Abita Springs, Pennell 4150 (PENN); Vernon Parish 2 miles west of Leander, Webster & Wilbur 3241 (MICH).

TEXAS: Hardin Co., Sour Lake, Tharp 29 July 1929 (TEX); Harris Co., Houston, Hall 509 (BRU, F, GH, MO, NY); Henderson Co., without exact locality, Tharp 2882 (US); Houston Co., Grapeland, Palmer 14405 (MO, US); Jasper Co., Jasper, Fisher 32117 (F); Jefferson Co., Beaumont, Hooks 14 July 1931 (TEX); Liberty Co., 21 miles southeast of Cleveland, Webster & Wilbur 3171 (MICH); Orange Co., Orange, Letterman 11 Aug. 1880 (MO); Rusk Co., without exact locality, Vinzent 39 (MO); Smith Co., without exact

locality, Tharp 5 July 1924 (TEX); Trinity Co., Big Thicket, Murray 1 June 1938 (NA); Tyler Co., 2 miles north of Warren, Webster & Wilbur 3204 (MICH).

This species is unmistakable once the distinctive characteristics of the plant are understood. The combination of a pluripetalous corolla and an annual habit alone sets this species off from all the members of Section Eusabatia. These two features together with sessile to subsessile flowers arranged in capitate to subcapitate clusters, and the laterally half-twisted anthers (as opposed to revolute) are shared by both S. gentianoides and S. boykinii which together form section Pseudochironia. S. gentianoides is not only clearly distinguished morphologically by its strongly dimorphic basal and cauline leaves but also by its restriction to the Coastal Plain which contrasts sharply with the southern Appalachian endemic, S. boykinii. Elliott's species is one of the most easily recognizable and least misunderstood of all the species. In spite of this it has been surprisingly often misidentified; ten to fifteen per cent of the specimens that I have seen were misnamed. This is at least in part because of the incomplete ranges published in Small's Flora (1903) "Ga. to Fla." and also in his Manual (1933) "Fla. to Tex. and Ga." The species is known to range from Texas to Florida and northward throughout eastern North Carolina. One station is known within ten miles of the North-Carolina-Virginia state line; but,

in spite of the very intensive collecting in southeastern Virginia, S. gentianoides is not known from within the "Gray's Manual range."

S. oligophylla is clearly only a synonym of S. gentianoides as is strongly indicated from a reading of the original description and conclusively shown by a water-color plate drawn for Professor Featherman and preserved at the Gray Herbarium. Featherman thought that it differed from S. gentianoides for that species "which it seems to resemble, has no bracts." S. gentianoides does, of course, possess bracts at the base of each flower.

DOUBTFUL AND EXCLUDED SPECIES

Chironia decandra Walt., Fl. Car. 95. 1788.

See discussion under *Sabatia bartramii* Wilbur

Pleienta fasciculata Raf., Fl. Tell. 3:30. 1837. *Nomen nudum.*

Pleienta leucantha Raf., New Fl. 4. 92. 1838.

> 974. Pleienta leucantha R. slender 2-3chotome branches anceps, leaves lanceolate acute hardly trinerve, flowers on long peduncles, calyx 8-10 parted linear, corolla double of calix, segments cuneate obtuse--this is the *Sab. gracilis* of many botanists, but not of all, the true one not being a Pleienta! on Sea Shores from South New Jersey to Florida, pedal, leaves uncial, flowers large and fine, sometimes 2 inches wide.

This description and the range is, at least in part, that of *Sabatia dodecandra* (L.) B.S.P. It has nothing to do with *S. campanulata* (L.) Torr. to which it was referred by Merrill (1949, p. 193).

Pleienta quinquenervia Raf., New Fl. 4: 91. 1838.

> 973. Pleienta quinquenervia Raf. stem terete trichotome, leaves broad oblong lanceolate acute thin 5nerved; flowers corymbose, calix base membranose, 6-7parted, segments foliose lanceolate subequal to corolla segments oblong obtuse--in Louisiana, sent me by Riddel as *Sabbatia gracilis* ? pedal, not slender, foliose, leaves large often 2 inches long, flowers few white terminal, peduncles thick erect uncial. My G. *Pleienta* fl. tel. 497 includes all Sabbatias with unequal multiple calix and corolla, 6--12stamens, style erect.

This is perhaps a synonym of *Sabatia calycina* (Lam.) Heller.

Pleienta rigida Raf., Herb. Raf. 80. 1833.

Publication not seen. Merrill (1949, p. 193) reports it as having been listed from "Alabama or Florida" and "= Sabatia dodecandra (Linn.) Britton, Sterns & Poggenb. (S. chloroides Pursh), et S. decandra (Walt.) Harper." Probably a synonym of what is here called S. bartramii Wilbur.

Sabbatia albeola Raf., Cat. Bot. Gard. Trans. Univ. 15. 1824. Nomen nudum.

Sabbatia amena Raf., Fl. Tell. 3:30. 1837. Nomen nudum.

Perhaps a misprint for "amoena" and intended to refer to his earlier Chironia amoena (Med. Repos. II. 5: 389. 1808.) which was the earliest name applied to Sabatia stellaris Pursh.

Sabbatia anceps Raf., Fl. Tell. 3: 30.1837. Nomen nudum.

Sabbatia australis Cham. & Schlect., Linnaea 1: 194. 1826. Zygostigma australe (C. & S.) Griseb., Gen. et Sp. Gent. 50. 1839.

Sabbatia centaurium (L.) Raf., Casket 1827: 316. f. 29. 1827.

Publication not seen. Merrill (1949, p. 193) states that this name was based upon Gentiana centaurium L. which is now called Centaurium umbellatum Gilib.

Sabbatia decandra (Walt.) Harper, Bull. Torrey Club 27: 432. 1900.

See discussion under Sabatia Bartramii Wilbur.

Sabbatia declinata Raf., Herb. Raf. 69. 1833.

Publication not seen. Merrill (1949, p. 193) lists it as follows: "nom. Long Island, New Jersey, Chesapeake

Bay." It is probably a synonym of S. stellaris Pursh.

Sabbatia heterophylla Raf., Fl. Tell. 3:30 1837. Nomen nudum.

Sabbatia lingulata Raf., Fl. Tell. 3: 30. 1837. Nomen nudum.

Sabbatia nivea Raf., Med. Fl. 2: 77. 1830.

> S. nivea Raf. Stem slender, with four angles; leaves distant, cuneate, oblong; flowers tricotome; calyx turbinate, segments equal subulate, corolla double in length, snow white, segments narrow, cuneate obtuse. Discovered in 1824, in east Kentucky, near the river Cumberland.

The description is rather reminiscent of S. quadrangula Wilbur but that species is not known from Kentucky or from any locality west of the Appalachian Mountains. Only S. angularis (L.) Pursh and S. campanulata (L.) Torr. are as yet known from Kentucky.

Sabbatia obtusifolia [as obtusif.] Raf., Fl. Tell. 3: 30. 1837. Nomen nudum.

Sabbatia petiolata Raf., Fl. Tell. 3: 30. 1837. Nomen nudum.

Sabbatia pulchella (Sw.) Spreng., Syst. ed. 16. 581. 1825. = Centaurium pulchellum (Sw.) Druce.

Sabbatia pulchella [as pulchela] Raf., Herb. Raf. 69. 1833. Publication not seen. Merrill (1949, p. 193) states that it was listed from "Long Island, New Jersey, Chesapeake Bay" and "= Sabatia gracilis Salisb. = S. campanulata (Linn.) Britton." However, if it is not the Centaurium listed above, it is more likely another synonym of S. stellaris Pursh.

Sabbatia pumila Raf., Herb. Raf. 69. 1833.

Publication not seen. Merrill (1949, p. 193) provides the following information: "nom. Long Island, New Jersey, Chesapeake Bay." Perhaps, judging from the stated localities, another synonym of S. stellaris Pursh.

Sabbatia simplex Bertol., Misc. Bot. 10. 27 (1842-1863).

Publication not seen. A. Gray (Syn. Fl. 2(1): 116. 1878), equates this name with Rhexia stricta Pursh.

Sabbatia stricta Raf., Fl. Tell 3: 30. 1837. Nomen nudum.

Sabbatia tenuifolia.Raf., Fl. Tell. 3: 30. 1837. Nomen nudum.

Sabbatia umbellata Raf., Fl. Tell. 3: 30. 1837. Nomen nudum.

Sabbatia verticillaris Spreng., Syst. ed. 16. 580. 1825.

Described from South America. Grisebach (Prodr. 9: 50. 1845) equates this species with Schuebleria stricta Mart. which is a synonym of Curtia gentianoides Cham. & Schlecht.

SUMMARY

1. The history of the genus is reviewed and the significant contributions of the past outlined.
2. A review of the Gentianaceae is strongly warranted as is shown by our scant knowledge of interfamilial relationship and phylogeny at the present time. Sabatia seems clearly distinct from any other genus. Centaurium, with which it has been most commonly aligned in the past, is strongly differentiated; the distinctions are indicated. Lapithea Griseb., a segregate from Sabatia, is not maintained as a valid genus.
3. The seventeen species and two varieties recognized in the present study are naturally arranged in six species groups. Five of these groups seem to be more closely related to one another than to the sixth. The two larger units are treated as sections and the lesser units as subsections.
4. The distribution of each of the species is discussed briefly in relation to the significant paleogeographic history of the area occupied. Woodson's recent strong advocacy of the importance of three principal refugia in the development and migration of the flora of eastern North America is considered in particular.
5. Promising types of investigation within the genus,

especially those whose necessity was made apparent in the present study, are indicated. Cytological and genetical study is greatly needed. The annuals, at least, may be readily grown in cultivation and offer a tempting opportunity for further work.

6. More than six thousand sheets from over thirty herbaria were examined. Distribution maps have been prepared and a specimen of each species cited from each county in which it is represented.

7. Keys and descriptions for all recognized species and varieties are presented. The nomenclature is that of the International Rules of Botanical Nomenclature. Where there was some question of interpretation involved, the reasons for adopting the name here employed are discussed.

8. Subsection Difformes Wilbur, composed of but two species, is proposed as deserving recognition.

9. Sabatia recurvans Small is evaluated and varietal recognition is accorded it under S. macrophylla.

10. Chironia paniculata Michx. is shown to be based upon a rhizomatose perennial and hence is considered a synonym of S. difformis (L.) Druce. The rosulate annual, previously called Sabatia paniculata (Michx.) Pursh, is renamed S. quadrangula.

11. The type of S. brachiata Ell. f. candida Fern. proved to be S. quadrangula.

12. The identity of S. concinna Wood is discussed and tentatively considered as a later synonym of S.

brachiata Ell. rather than S. campestris Nutt. as maintained by Merrill.

13. Sabbatia nervosa Raf. and Neurola arkanzica Raf. are later synonyms of Sabatia campestris Nutt.

14. Sabatia carnosa Small was found to be indistinguishable from the previously named S. arenicola Greenm.

15. The alleged differences between the two varieties of S. campanulata maintained by Fernald proved untenable. Sabatia campanulata var. gracilis is not recognized.

16. Sabbatia Tracyi Gandoger is a later synonym of Sabatia campanulata (L.) Torr.

17. Sabbatia maculata, S. palmeri, S. purpusii (all three of Mexico), S. nana (of Louisiana), and S. simulata (of the Bahamas) are all interpreted as synonymous with S. stellaris Pursh.

18. S. grandiflora (A. Gray) Small is recognized as of specific rank and its affinities indicated as being closer to S. stellaris than to S. campanulata. Sabatia alainii of Cuba is treated as a synonym of S. grandiflora.

19. Sabatia brevifolia Raf. is considered to be an earlier name for the species formerly passing as S. elliottii Steud.

20. Subsection Dodecandrae is a new subsection provided to designate the group of species formerly referred to as Sect. Pleienta (Raf.) Blake. Pleienta is believed to be illegitimate in any rank when based upon Rafinesque's

name. Specific epithets published in combination with Pleienta are not considered available for transfer.

21. Sabatia calycina (Lam.) Heller is thought to be more closely related to the species of Subsect. Dodecandrae than to those of the Campanulatae with which it has been formerly associated.

22. Sabbatia cubensis (Griseb.) Urb. is treated as a synonym of S. calycina.

23. Sabbatia foliosa is treated as a variety of S. dodecandra; S. Harperi and S. obtusata are treated as synonyms of the former.

24. Sabatia kennedyana Fern. is shown to possess a tricentric range: Nova Scotia, eastern Massachusetts and southern Rhode Island, and southeastern North Carolina and northeastern South Carolina. The presence of this species in the Carolinas is reported for the first time.

25. Sabatia bartramii is a new name applied to the species long known as S. decandra based upon Chironia decandra Walt. Sabatia bartramii is not known within one hundred and fifty miles of Walter's area and the brief description provided by Walter is equally descriptive of S. kennedyana which is found even closer to Walter's home. Chironia decandra is treated as a nomen dubium.

26. Sabatia boykinii is accepted as the valid name of the plant that has been known for the past twenty-five years as S. capitata. The latter name, being based

on *Pleienta capitata*, is considered illegitimate.

27. A list of all excluded or doubtful species is provided and each is individually discussed.

LITERATURE CITED

Adanson, M. 1763. Familles des plantes. Paris. 2 vols. cccxxv, 189; 640 pp.

Bentham, G. and Hooker, J. D. 1862-1883. Genera plantarum. London. 3 vols. (Gentianaceae by Bentham 2(2):799-820. 1873.)

Blake, S. F. 1915. Notes on the genus Sabatia. Rhodora 17: 50-57, pl. 112.

Britton, N. L. and Millspaugh, C. F. 1920. The Bahama flora. New York. viii, 695 pp.

Camp. W. H. 1941. A discussion of the genus Befaria in North America. Bull. Torrey Club 68: 100-111.

Chapman, A. W. 1860. Flora of the southern United States. Ivison, Phinney and company. New York. xxxvii, 621 pp.

Deam, C. C. 1940. Flora of Indiana. Indiana Dept. of Conservation, Div. of Forestry. Indianapolis. 1236 pp.

Don, G. 1838. A general history of dichlamydeous plants. J. G. and F. Rivington. London. 4 vols. (Sabatia in 4: 206-207.)

Elliott, S. 1816-1824. A sketch of the botany of South Carolina and Georgia. J. R. Schenck. Charleston. 2 vols 666; viii, 741 pp. (Sabatia in 1: 282-287. 1817.)

Ewan, J. 1948. A revision of Macrocarpaea, a neotropical genus of shrubby gentians. Contr. U. S. Nat. Herb. 29(5): 209-249.

Fernald, M. L. 1911. A botanical expedition to Newfoundland and southern Labrador. Rhodora 13: 109-161.

_____. 1916. The genus Sabatia in New England. Rhodora 18: 145-152. pl. 121.

_____. 1931. Specific segregations and identities in some floras of eastern North America and the Old World. Rhodora 33: 25-63.

_____. 1950 Gray's Manual of Botany. ed. 8. The American Book Company. New York. lxiv. 1632 pp.

Fraser, J. 1789. A short history of the Agrostis Cornucopiae; ...and also some account of a journey to the Cherokee Nation in search of new plants. London. 8 pp.

Gilg, E. 1895. [Gentianaceae in] Die natürlichen Pflanzenfamilien. 4(2): 50-108.

Gray, A. 1848. A manual of the botany of the northern United States. J. Munroe and company. Boston. lxxii, 710 pp.

_____. 1878. The synoptical flora of North America. ed. 1. (Sabatia in 2(1): 113-116.)

Grisebach. A. H. R. 1839. Genera et species gentianearum. Stuttgart. viii, 364 pp.

_____. 1845. [Gentianaceae in] Prodromus systematis naturalis regni vegetabilis. Paris. 9:38-141.

Gronovius, J. F. 1739. Flora virginica. Leiden.

Hooker, W. J. 1836. Notice concerning Mr. Drummond's collections made chiefly in the southern and western parts of the United States. Comp. Bot. Mag. 1:39-49, 95-101, 170-177; 2: 60-64, not completed.

Huxley, T. H. 1887. The gentians: notes and queries. Jour. Linn. Soc. 24: 101-124.

Lanjouw, J. and Stafleu, F. A. 1952. The herbaria of the world. Regnum Vegetabile 2: 1-167.

Kearney, T. H. 1900. The lower austral element in the flora of the southern Appalachian region. Science 12: 830-842.

Lindsey, A. A. 1940. Floral anatomy in the Gentianaceae. Am. Jour. Bot. 27: 640-652.

Linnaeus, C. 1753. Species plantarum. Stockholm. 2 vols.

McVaugh, R. 1936. Studies in the taxonomy and distribution of the eastern North American species of Lobelia. Rhodora 38: 241-263, 276-298, 305-329, 346-362.

Merrill, E. 1949. Index Rafinesquianus. Arnold Arboretum. ix, 296 pp.

Michaux, A. 1803. Flora boreali-americana. Paris. 2 vols. x, 330: 339 pp. (Chironia in 1: 146-147.)

Muehlenberg, H. 1813. Catalogus plantarum americanae septentrionalis. W. Hamilton. Lancaster. iv. 122 pp.

Nuttall, T. 1818. The genera of North American plants. 2 vols. viii, 312; 254 pp. (Sabatia in 1: 134.)

Pennell, F. W. 1935. The Scrophulariaceae of eastern temperate North America. Acad. Nat. Sci. Phil. Monog. 1. xiv. 650 pp.

Persoon, C. 1805 & 1807. Synopsis plantarum. Paris. 2 vols. xii, 546; 657 pp. (Chironia in 1: 282-283.)

Pursh, F. 1814. Flora americae septentrionalis. White, Cochrane and company. London. 2 vols. xxxvi, 751 pp. (Sabatia in 1: 137-138.)

Rafinesque, C. S. 1828 & 1830. Medical Flora; or, manual of the medical botany of the United States of North America. Atkinson and Alexander. Philadelphis. 2 vols. xii. 268, 276 pp.

_____. 1837. Flora Telluriana. Philadelphia. 4 vols. (Sabatia in 3: 30-31.)

St. John, H. P. 1935. Rare ferns of central Florida. Am. Fern Jour. 26: 41-50.

Salisbury, R. A. 1806 & 1807. The Paradisus Londinensis. Wm. Hooker. London, 2 vols.

Schornherst, R. C. 1943. Phytogeographic studies of the mosses of northern Florida. Am. Midl. Nat. 29:509-532.

Schuchert, C. 1935. Historical geology of the Antillean-Caribbean region. J. Wiley and sons. New York. xxvi, 811 pp.

Small, J. K. 1903. Flora of the southeastern United States. New York xii, 1370 pp.

_____. 1913. Flora of the Florida Keys. New York. xii, 162. pp.

_____. 1913. Flora of Miami. New York. xii. 206 pp.

_____. 1933. Manual of the southeastern Flora. New York. xxii, 1554 pp.

Walter, T. 1788. Flora caroliniana. London, viii, 263 pp.

Wherry, E. T. 1935. Description and notes on distribution in Walcott, M. V., Illustrations of North American pitcherplants. Smithsonian Institution. 34 pp.

Wood, A. 1847. Class-Book of Botany. ed. 2. Crocker and Brewster. Boston. 654 pp.

_____. 1861. Class-Book of Botany, ed. 1861. Barnes and Burr. New York. viii. 832 pp.

Wood, A. 1870. The American botanist and florist. A. S. Barnes and company. New York. 2 vols.

Woodson, R. E. Jr. 1947. Notes on the "historical factor" in plant geography. Contr. Gray Herb. no. 165: 12-25.