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A taxonomic treatment of the Gentianaceae in Virginia

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College of William & Mary - Arts & Sciences

Thou waitest late, and com'st alone
When woods are bare and birds have flown,
And frosts and shortening days portend
The aged year is near his end.

Then doth thy sweet and quiet eye
Look through its fringes to the sky
Blue - blue - as if that sky let fall
A flower from its cerulean wall.

- Bryant
from Wildflowers of the Alleghanies

APPROVAL SHEET

This thesis is submitted in partial fulfillment of

the requirements for the degree of

Master of Arts

Georgia A. Hammond-Gibbs

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Approved September, 1979

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ABSTRACT

This study of the Gentianaceae has been undertaken in order to provide keys, descriptions, habitat, and distributional information for the members of the Gentianaceae found in Virginia.

Twenty one species comprising six genera (Centaurium, Bartonia, Obolaria, Sabatia, Nymphoides, and Gentiana) were included in the study. Herbarium specimens and collections made by the author were examined. Additionally, a flavonoid study of three species of Gentiana was undertaken in order to elucidate their relationship.

Technical keys and a description of each species are provided. Distribution maps accompany the description of each species. Flavonoid data clarify relationships among Gentiana catesbaei, Gentiana quinquefolia, and Gentiana saponaria.

A TAXONOMIC TREATMENT

OF THE GENTIANACEAE IN VIRGINIA

INTRODUCTION

Treatments of the Gentianaceae in floristic manuals are often confusing and inadequate. This study of the Gentianaceae has been undertaken in order to provide keys, descriptions, and habitat and distributional information for the members of the Gentianaceae found in Virginia: Centaurium, Bartonia, Obolaria, Gentiana, Nymphoides, and Sabatia. Twenty one species are among the six genera included in this study, and approximately six hundred forty plant specimens were examined including a number of collections made by the author. The following herbaria provided plant specimens for use in this study: University of North Carolina (NCU), Virginia Polytechnic Institute and State University (VPI), Longwood College (FARM), Randolph-Macon Women's College (RMWC), Lynchburg College (LYN), Old Dominion University (ODU), College of William and Mary (WILLI), George Mason University (GMUF), Shenandoah National Park (SNP), Virginia Commonwealth University (VCU), and U.S. National Herbarium (US). Distributional maps are included with the description of each species. County records are signified by dots in the appropriate county spaces.

The Gentianaceae belong to the order Gentianales as defined by Cronquist (1968) which consists of the Loganiaceae, Gentianaceae, Apocynaceae, and Asclepiadaceae. Seventy genera and eight hundred species comprise the family (Lawrence, 1951). The Gentianaceae are most abundant in the temperate regions, although their distribution is world-wide, including some alpine species. The members of the Gentianaceae are of little economic importance, although species representative of several genera are used as ornamentals. Gentiana crinita is the only species known from Virginia which is listed as cultivated by Bailey (1949).

Gentiana

According to Lawrence (1951), there are forty species of Gentiana native to North America, eight of which are found in Virginia. Six of the Gentiana species occurring in Virginia, Gentiana catesbaei, G. saponaria, G. clausa, G. austromontana, G. decora, and G. villosa belong to the section Pneumonanthae. Chromosome counts for Gentiana saponaria, G. clausa, G. decora, and G. villosa of 2n=26 are reported by Rork (1949). No chromosome counts have been reported for either Gentiana catesbaei or G. austromontana. In his taxonomic treatment of Pneumonanthae, Pringle (1967) points out the great variability of morphological characters found in the closely related species, Gentiana saponaria and G. catesbaei, which occur sympatrically in parts of Virginia. This variability has led to some confusion in adequately delimiting the two species, and I have undertaken a flavonoid chemistry study in an attempt to elucidate the relationship between these two taxa. A complete discussion of this study can be found in the chapter on flavonoid chemistry.

The remaining two Virginia Gentiana species are Gentiana quinquefolia and G. crinita. Gillett (1957) placed both Gentiana quinquefolia and G. crinita in the genus Gentianella based on morphological characters which include the absence of appendages between the corolla lobes which are present in Gentiana, sensu stricto, and the position of their nectar glands on the corolla surface rather than at the base of the ovary as in Gentiana, sensu stricto. Much confusion exists regarding the separation of Gentiana and Gentianella. Moench in 1794 separated the genus Gentianella from Gentiana (Gillett, 1957). Lindsey's work (1940) on the floral anatomy of the Gentianaceae showed that there were nectary position, as well as

carpel anatomy differences between the two groups comprising Gentiana and Gentianella. However, he found further anatomical distinctions within each of the two groups, so that he lists four basic types of floral anatomy in Gentiana, sensu lato, with two types characterizing each group. Weaver and Rüdenberg (1975) report several base chromosome numbers for Gentiana, sensu stricto, including x=5, x=9, and x=13. But, according to Weaver and Rüdenberg (1975) Gentianella appears to be quite constant in base chromosome number, with x=9. However, only thirty of approximately two hundred fifty Gentianella species have been counted, and Weaver and Rüdenberg list several exceptions to this base number of x=9. Moreover, they fail to mention at least one other exception, namely, Gentiana crinita with a mitotic count of 2n=78 (Rork, 1949). The work of Lindsey (1940) and Weaver and Rüdenberg (1975) lend support to the differences that Gillett uses in affording Gentianella generic rank; however, the relationship between Gentiana and Gentianella remains unclear. Most taxonomists still follow the work of Kusnezow (in Engler and Prantl, 1895) who divided Gentiana into two subgenera, Eugentiana and Gentianella, and I am following that usage as well.

All eight Gentiana species found in Virginia are restricted in their distributions to the eastern half of North America. Gentiana catesbaei and G. saponaria are both primarily Coastal Plain species, although the range of G. saponaria often extends into the Piedmont. The distributions of Gentiana clausa, G. decora, and G. austromontana are limited to the mountains with G. clausa and G. austromontana concentrated in northern and western Virginia, while G. decora is found almost exclusively in southwestern Virginia. Gentiana villosa is found throughout Virginia, and G. quinquefolia is found in both the mountains and the Piedmont, but it

is entirely absent from the Coastal Plain. With only one collection of Gentiana crinita in the entire state (Montogmery Co.), few generalizations can be made about its distribution. Radford, Ahles, and Bell (1968) list records of G. crinita from three counties in the mountains of North Carolina and Gillett (1957) cites a specimen from one county in West Virginia. Therefore, the distribution of Gentiana crinita in Virginia is probably limited to extremely rare occurrences in the mountains. None of the Gentiana species found in Virginia are common. Most occur quite infrequently within their ranges, and only Gentiana quinquefolia is occasionally locally abundant.

Habitat preferences for Gentiana species range from open wooded areas and mountaintop meadows (Gentiana clausa, G. decora, G. austromontana, and G. quinquefolia) to wet thickets, sphagnous swamps, and swales (G. saponaria and G. catesbaei) to mesic woodlands (G. villosa).

Sabatia

Sabatia is indigenous to North America and the West Indies. The genus consists of seventeen species, eight of which are found in Virginia. The Sabatia species in Virginia are separated by differences in growth habit and root form, branching pattern, and number of flower parts. Wilbur (1955), in his revision of Sabatia, divided the genus into five subsections on the basis of a combination of these characters.

Most Sabatia species are restricted in their distribution to the Coastal Plain. Sabatia difformis is found in sandy and peaty savannas, and S. campanulata is found in bogs and savannas along the Coastal Plain. Sabatia brachiata is limited to dry fields, sandhills, and pine woods in

southeastern Virginia. Both Sabatia stellaris and S. dodecandra are restricted to brackish marshes along the Coastal Plain, and S. calycina occurs along riverbanks and in cypress swamps on the Coastal Plain. Only the distributions of Sabatia angularis and S. quadrangula extend inland. Sabatia angularis, the most common of the Sabatia species, is found in fields, open woods, cut over areas, and along roadsides throughout the state, while Sabatia quadrangula occurs in open fields and cutover areas in both the Coastal Plain and the Piedmont regions of Virginia.

Sabatia quadrangula is applied in this work to specimens previously identified as S. paniculata. Wilbur (1955) in his revision of the genus states that Sabatia paniculata has been the source of much confusion, and that various authors have applied this name to at least three different species. He, therefore provided a new name, Sabatia quadrangula, for the species and designated a type specimen.

Some biosystematic work has been done recently on Sabatia by Perry (1971) who attempted to elucidate species relationships by examining breeding systems, chromosome counts, pollen morphology, and experimental hybridization. Chromosome number in Sabatia varies considerably, with several different base numbers reported within the individual subsections of the genus which were established by Wilbur (1955), and which are viewed as quite distinct morphologically. Palynological studies, utilizing light microscopy, revealed no differences among Sabatia species (Perry, 1971). However, Perry did not undertake SEM studies of the pollen, which might reveal significant species differences undetectable at the light microscopic level. Pollen size also proved of little value in assessing species relationships (Perry, 1971). Although no known natural hybrids occur within Sabatia, Perry (1971) reports successful artificial hybridiza-

tions among most species. Crosses among members of the same subsection typically resulted in seed set, although it was at times rather limited. Intrasubsectional crosses produced variable results. In general, Perry (1971) concluded that these data support the species relationships which Wilbur (1955) had established on the basis of morphology. Flavonoid chemistry and detailed karyotypic studies in Sabatia might provide additional information regarding species relationships.

Bartonia

The genus Bartonia, comprised of three species, is native to North America. Two of the three species, B. virginica and B. paniculata, are found in Virginia. Bartonia virginica, the most common, is found in a variety of habitats including swamp margins, lake shores, and wet woodlands and meadows throughout the state, although only one collection has been made in the southwestern portion of Virginia. Bartonia paniculata generally occurs in wet localities such as swamps and wet thickets. Most of the collections of B. paniculata in the state have been from the Coastal Plain, although it does occur sporadically throughout the state.

Rork (1949) reported chromosome counts for Bartonia virginica and B. paniculata of n=26. Gillett (1959), in his taxonomic treatment of the genus, suggests that additional cytological studies might be helpful in further understanding species relationships within Bartonia.

Obolaria

Obolaria is a monotypic genus native to North America. Obolaria virginica is distributed throughout Virginia, generally occurring in rich deciduous woods. The only cytological work published on the species is

by Kondo (1970) in which a gametic chromosome number of n=28 is reported. It appears that biosystematic techniques such as flavonoid chemistry might be usefully employed in establishing the relationship of Obolaria to other genera in the Gentianaceae.

Nymphoides

The aquatic genus Nymphoides is composed of twenty species, two of which are native to North America. Nymphoides aquatica, one of the latter species, is the only species that occurs in Virginia. It is quite rare in Virginia, with collections from only two Coastal Plain counties. Gleason and Cronquist (1963) state that the distribution of the species is restricted to quiet waters of the Coastal Plain. Ornduff (1970) reports a chromosome number of n=18 for Nymphoides aquatica.

Centaurium

Lawrence (1951) reports that five of the thirty species of Centaurium are native to North America. Centaurium pulchellum, the only species found in Virginia, however, is not native to North America, but European in origin. Gleason and Cronquist (1963) state that C. pulchellum occurs locally in fields and waste areas. It would appear that the distribution of this species is indeed quite local in Virginia, with Parramore Island in Accomack Co. being the only location where it has been collected. Federov (1969) reports widely varying mitotic counts of 2n=20, 40, 36, 42, 54, and 56 for Centaurium pulchellum.

FLAVONOID CHEMISTRY

The study of flavonoid compounds has proved useful in establishing species relationships in the angiosperms. Alston and Turner (1958), in one of the pioneering flavonoid chemistry studies, utilized flavonoid patterns to define specific boundaries and to demonstrate the occurrence of natural hybrids in Baptisia.

Since that time flavonoid chemistry has been widely employed in systematic studies. The following selected examples point out the utility of the application of flavonoid chemistry to plant systematics. Flavonoid chemistry studies have revealed chemical differences between different ploidy levels of the same species in Briza (Williams and Murray, 1972), and between isolated populations of the same species in Chenopodium (Crawford and Mabry, 1978).

The present flavonoid chemistry study of three species of Gentiana has been undertaken in an attempt to more clearly separate Gentiana saponaria and G. catesbaei, two species which occur sympatrically in parts of Virginia and exhibit significant morphological variation. Gentiana quinquefolia was included in the study as a species with a very different morphology from the other two Gentiana species in order to serve as a basis for comparison. In this manner it was hoped that some statement could be made about flavonoid compounds which commonly occur within the genus Gentiana.

Methods

Mabry et al. (1970) developed a set of techniques for the isolation and identification of flavonoid compounds. With minor modifications, the methods employed in this study follow those discussed in Mabry et al. (1970).

Vegetative material from dried plant specimens was finely ground in a Waring blender, placed in an Erlenmeyer flask, and extracted with chloroform for 48 hours. Chloroform, a solvent in which flavonoids are insoluble, was used in order to extract chlorophylls, as well as lipids and oils, all of which interfere with flavonoid analysis using paper chromatography. After filtration, the chloroform solvent was discarded, and the plant material was allowed to dry. The dried material was subsequently placed in a clean Erlenmeyer flask and extracted in methanol for 72 hours. The solution was again filtered, the plant material discarded, and the remaining methanol solvent evaporated to dryness using a flash evaporator. The residue was then redissolved in a small quantity of methanol in order to concentrate the extract.

The extract was then applied in one corner of a 46 X 57 cm piece of Whatman 3 MM chromatography paper. First the extract was run down the long axis of the paper for 24 hours in TBA (t-butyl alcohol: glacial acetic acid: water in a ratio of 3 : 1 : 1). Then the extract was run along the short axis of the paper in HOAc (15% glacial acetic acid). The completed 2-dimensional chromatogram was dried and examined under ultraviolet light in order to locate the flavonoid compounds and to determine any diagnostic color changes that might occur after exposing the spots to NH_4OH vapors. R_f values for each spot were also determined.

Often individual flavonoid spots were not completely pure following 2-dimensional chromatography due to partial overlap with various other phenolic compounds present in the plant. In this case the flavonoid spots were cut out, eluted in reagent grade methanol for 24-48 hours, and then rechromatographed 1-dimensionally in either HOAc or TBA (see Mabry et al., 1970 for details of this procedure) in order to obtain a pure

flavonoid sample.

Identical spots from several chromatograms representing an individual species were cut out and combined for spectrophotometric identification. The sample was cut into small pieces, placed in a flask, covered in spectral grade methanol (made specifically for spectrophotometric work), and shaken for 15 min. The solvent was filtered, evaporated to dryness in a flash evaporator, and then redissolved and concentrated in a small amount of spectral grade methanol.

The extracted compounds were analyzed using an ultraviolet spectrophotometer. The reagents and spectrophotometric techniques employed were the same as those utilized by Mabry et al. (1970). The spectra generated by the addition of the reagents to the purified flavonoid provided data which were used to establish the structure of the flavonoid compound. The following is a list of the reagents used in the spectrophotometric analyses.

Spectrum 1. Flavonoid extracts in spectral grade methanol.

Spectrum 2. $AlCl_3$ + flavonoid extract in spectral grade methanol.

Spectrum 3. HCl + $AlCl_3$ + flavonoid extract in spectral grade methanol.

Spectrum 4. NaOMe + flavonoid extract in spectral grade methanol.

Spectrum 5. NaOAc + flavonoid extract in spectral grade methanol.

Spectrum 6. H_3BO_3 + NaOAc + flavonoid extract in spectral grade methanol.

Identification of flavonoid compounds is based on peak values and peak shifts in the spectra, R_f values for the compound, and color changes in the presence of NH_4OH vapors. R_f values and color changes in the presence of NH_4OH vapors (in ultraviolet light) are generally diagnostic

of certain classes of flavonoids. These data are useful, therefore, in assessing the type of flavonoid compound under study. The location of the first peak or Band I of the flavonoid extract in spectral grade methanol (Spectrum 1) with a range between 250 and 400 nm indicates that the compound in the extract is indeed a flavonoid and provides information regarding the type of flavonoid. The position of the second peak or Band II provides additional data concerning the structure of the flavonoid. Identification of the substituents (hydroxyls, methoxyls, or sugars) which are attached to the flavonoid skeleton is dependent upon data obtained from the spectra of the various reagents (Spectra 2-6). These spectra generally show some shifting of the peaks when compared to the original methanol spectrum (Spectrum 1). For example, NaOMe is strongly basic and ionizes the hydroxyl groups present on the flavonoid. Therefore, data regarding hydroxyl group positions can be obtained from the NaOMe + flavonoid extract in the spectral grade methanol spectrum (Spectrum 4). In the case of hydroxyl group attachment at the 4' position on the flavonoid skeleton, Band I of the NaOMe spectrum will show a shift of 45-60 nm compared to Band I of Spectrum 1. Other reagents can bind the various substituent groups attached to the flavonoid skeleton. $AlCl_3$ can bind adjacent hydroxyl (-OH) groups or adjacent hydroxyl and keto (=0) groups, producing a large shift in the peak of Band I of the $AlCl_3$ spectrum (Spectrum 2) compared to the peak of Band I in Spectrum 1. It is in this manner that peak shifts provide data which can be used in identifying flavonoid compounds.

Results and Discussion

Comparison of the flavonoid spot patterns generated for the three species

of Gentiana under examination (Figs. 1-3) reveals similarities between the spot patterns of Gentiana saponaria and G. catesbaei, while the pattern exhibited by G. quinquefolia is completely different.

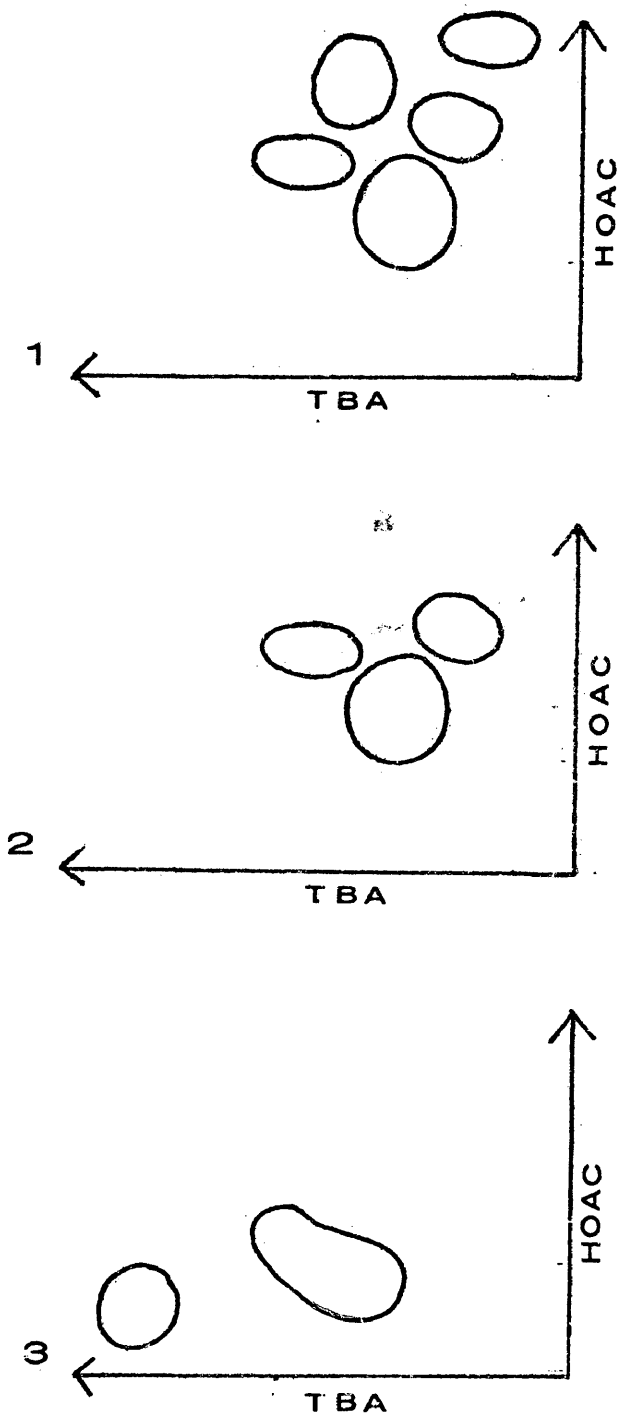
Utilizing ultraviolet spectral analyses, R_f values, and spot color appearances, an attempt was made to identify the compounds in the spots which were isolated from the three Gentiana species. These data are presented in Table 1.

The three flavonoid compounds found in Gentiana catesbaei are also found in G. saponaria. Clearly, this is chemical indication of the two species close relationship. However, the presence of two additional flavonoid compounds in Gentiana saponaria allows the two morphologically variable species to be easily separated on a chemical basis.

Work done on the European gentian, Gentiana asclepiadea (Goetz et al., 1976) which is placed in section Pneumonanthae along with G. catesbaei and G. saponaria, yielded some of the same flavonoids as were found in this study. These workers reported isoorientin, isovitexin, and their 4'-O- and 2'-O- glucosides in Gentiana asclepiadea. Both Gentiana catesbaei and G. saponaria contain isoorientin and isovitexin, indicating a chemical similarity within the section Pneumonanthae.

The flavonoid compounds found in Gentiana quinquefolia are quite distinct from those found in G. saponaria and G. catesbaei. Work done by Gillett (1957) places Gentiana quinquefolia in the genus Gentianella (see Gentiana discussion in Introduction). Clearly, there are chemical differences between Gentiana quinquefolia and G. catesbaei and G. saponaria. Whether these chemical differences constitute generic separation or only subgeneric separation can not be determined with the data available. However,

flavonoid chemistry studies appear to exhibit real potential for elucidating taxonomic relationships within this group.



Figs. 1-3 Flavonoid Spot Patterns for Gentiana Species.

Fig. 1. Flavonoid spot pattern for Gentiana saponaria.
Fig. 2. Flavonoid spot pattern for Gentiana catesbaei.
Fig. 3. Flavonoid spot pattern for Gentiana quinquefolia.

TABLE 1: Standard notation employed in flavonoid chemistry is used in the following table.

Compound A: Isolated from Gentiana saponaria and G. catesbaei

R_f Values: 0.75 (TBA)
0.56 (HOAc)

Spot Appearance: deep purple (UV)
yellow green (UV/NH_4OH)

UV Spectral Data: (λ_{max}, nm)

Spectrum	Band I	Band II
MeOH	330	270
$AlCl_3$	382, 349	300, 278, 260sh
$AlCl_3$ + HCl	380, 350	300, 280, 260sh
NaOMe	395, 330	275
NaOAc	350, 330	275
NaOAc + H_3BO_3	330	270

ISOVITEXIN

Compound B: Isolated from Gentiana saponaria and G. catesbaei

R_f Values: 0.56 (TBA)
0.36 (HOAc)

Spot Appearance: deep purple (UV)
yellow green (UV/NH_4OH)

UV Spectral Data: (λ_{max}, nm)

Spectrum	Band I	Band II
MeOH	350	270, 225, 240sh
$AlCl_3$	427, 330sh	280
$AlCl_3$ + HCl	380, 365	280
NaOMe	410, 330sh	270
NaOAc	400, 350	270
NaOAc + H_3BO_3	380	264

ISOORIENTIN

Compound C: Isolated from Gentiana saponaria and G. catesbaei

R_f Values: 0.31 (TBA)
0.53 (HOAc)

Spot Appearance: deep purple (UV)
yellow (UV/NH_4OH)

UV Spectral Data: (λ_{max}, nm)

Spectrum	Band I	Band II
MeOH	348	260
$AlCl_3$	425, 330sh	280
$AlCl_3$ + HCl	390, 360	270
NaOMe	410, 325	271
NaOAc	360	270
NaOAc + H_3BO_3	375	265

QUERCETIN 3-O-GLYCOSIDE

Compound D: Isolated from Gentiana saponaria

R_f Values: 0.55 (TBA)
0.67 (HOAc)

Spot Appearance: deep purple (UV)
yellow green (UV/NH_4OH)

UV Spectral Data: (λ_{max}, nm)

Spectrum	Band I	Band II
MeOH	355	272
$AlCl_3$	380, 350	300, 277
$AlCl_3$ + HCl	380, 345	300, 278
NaOMe	390	270
NaOAc	390, 335	270
NaOAc + H_3BO_3	330	270

APIGENIN 7-O-GLYCOSIDE

Compound E: Isolated from Gentiana saponaria

R_f Values: 0.09 (TBA), 0.83 (HOAc) Spot Appearance: purple (UV), purple (UV/NH_4OH)

UV Spectral Data: (λ_{max}, nm)

Spectrum	Band I	Band II
MeOH	320	270
$AlCl_3$	380, 340	315, 280
$AlCl_3$ + HCl	375, 345	303, 280
NaOMe	360	280sh, 270
NaOAc	380	300sh, 270
NaOAc + H_3BO_3	330	303sh, 273

Unknown flavone glycoside - UV spectral data revealed that in order to identify this compound any further would require Nuclear Magnetic Resonance.

Compound F: Isolated from Gentiana quinquefolia

R_f Values: 0.80 (TBA), 0.18 (HOAc) Spot Appearance: purple (UV), purple (UV/NH_4OH)

UV Spectral Data: (λ_{max}, nm)

Spectrum	Band I	Band II
MeOH	390sh, 330	275
$AlCl_3$	370, 327	290, 260
$AlCl_3$ + HCl	380, 329	295, 255
NaOMe	355	285
NaOAc	340	270
NaOAc + H_3BO_3	330	278

5,7-DIHYDROXY-3'-METHOXY FLAVONE

Compound G: Isolated from Gentiana quinquefolia

R_f Values: 0.47 (TBA)
0.34 (HOAc)

Spot Appearance: purple (UV)
green (UV/NH_4OH)

UV Spectral Data: (λ_{max}, nm)

Spectrum	Band I	Band II
MeOH	370sh, 325	275
$AlCl_3$	410sh, 360, 327	282, 265
$AlCl_3$ + HCl	410sh, 360, 327	282, 265
NaOMe	410sh, 350	285, 255
NaOAc	340	272
NaOAc + H_3BO_3	330	275

5,7,3'-TRIHYDROXY-6-C-GLYCOSYL FLAVONE

GENTIANACEAE OF VIRGINIA

Annual, biennial, or perennial, terrestrial or aquatic herbs. Leaves basal or cauline, simple, opposite or alternate, typically sessile. Inflorescence cymose; flowers perfect, gamopetalous, and usually gamosepalous. Calyx tubular; calyx lobes 2-12. Corolla rotate or tubular; corolla lobes 4-12. Stamen number equalling corolla lobe number; anthers 2-celled; filaments inserted on the corolla tube, alternating with the corolla lobes. Ovary superior, bicarpellate, unilocular with parietal placentation; ovules numerous. Stigma 2-lobed; style simple. Fruit a capsule with septicidal dehiscence. Seeds numerous.

KEY TO GENTIANACEAE

Plant aquatic; leaves typically single, very long-petiolate. . . . Nymphoides

Plant terrestrial; leaves numerous, typically paired, sessile.

Corolla lobes much longer than the corolla tube.

Leaves scalelike, subulate. . . . . Bartonia

Leaves foliaceous.

Leaves widest near apex, broadly obovate to broadly spatulate; calyx lobes 2, corolla lobes 4. . . . . Obolaria

Leaves widest near base, elliptic, ovate, or lanceolate; calyx lobes 5-12, corolla lobes 5-12. . . . . Sabatia

Corolla lobes shorter than the corolla tube.

Corolla salverform, corolla lobes 4, pink. . . . . Centaurium

Corolla tubular or campanulate, corolla lobes 4-5, blue to violet . . . . . Gentiana

NYMPHOIDES Hill

Nymphoides aquatica (Gmelin) O. Ktze., Rev. Gen. 2: 429. 1891.

Anonymos aquatica Walt., Fl. Carol. 109. 1788.
Villarsia aquatica Gmelin, Syst. I. 447. 1791.
Menyanthes trachysperma Michx., Fl. Bor.-Am. I: 126. 1803.
Limnanthemum trachyspermum A. Gray, Man. ed. 5. 390. 1867.
Limnanthemum aquaticum Britton, Trans. N.Y. Acad. Sci. 9: 12. 1889.

Herbaceous, aquatic, rhizomatous perennial. Stem glabrous. Leaves usually single, orbicular, 4-20 cm long, 3-18 cm wide, cordate, very long-petiollate. Calyx tube not well-developed; calyx lobes 5, oblong, 2-4 mm long, 1-2 mm wide. Corolla tube not well-developed; corolla lobes white, 5, 8-10 mm long, 2-5 mm wide. Stamens 5. Stigma 2-lobed; style quite short. Capsule dehiscence irregular, 5-7 mm long. Seeds 1.5 mm long. May-Sept. Quiet Coastal Plain waters.[1]

Specimens Examined

ACCOMACK: Wieboldt in 1975 (WILLI); VIRGINIA BEACH: Britton & Small in 1893 (US).

OBOLARIA L.

Obolaria virginica L., Sp. Pl. 632. 1753.

Shultzia obolarioides Raf., Med. Repos. II. 5: 356. 1808.
Shultzia virginica (L.) O. Ktze., Rev. Gen. 2: 430. 1891.

Purplish green herbaceous perennial. Stem simple or branched, 0.4-1.7 dm tall, thick and fleshy, slightly angled. Roots fleshy. Leaves opposite, sessile; lower cauline leaves scale-like, 0.4-1.5 cm long, 0.3-1.0 cm wide, appressed; upper cauline leaves very closely subtending the flowers, greenish purple, broadly spatulate to suborbicular. Inflorescence cymose; pedicels 0.5-2.0 mm long. Calyx tube not well-developed; calyx lobes 2, obovate, leaf-

[1]Most of the information contained in the description of Nymphoides aquatica was obtained from Radford et al. (1968) and Gleason and Cronquist (1963).

Nymphoides aquatica (Gmelin) O. Ktze.

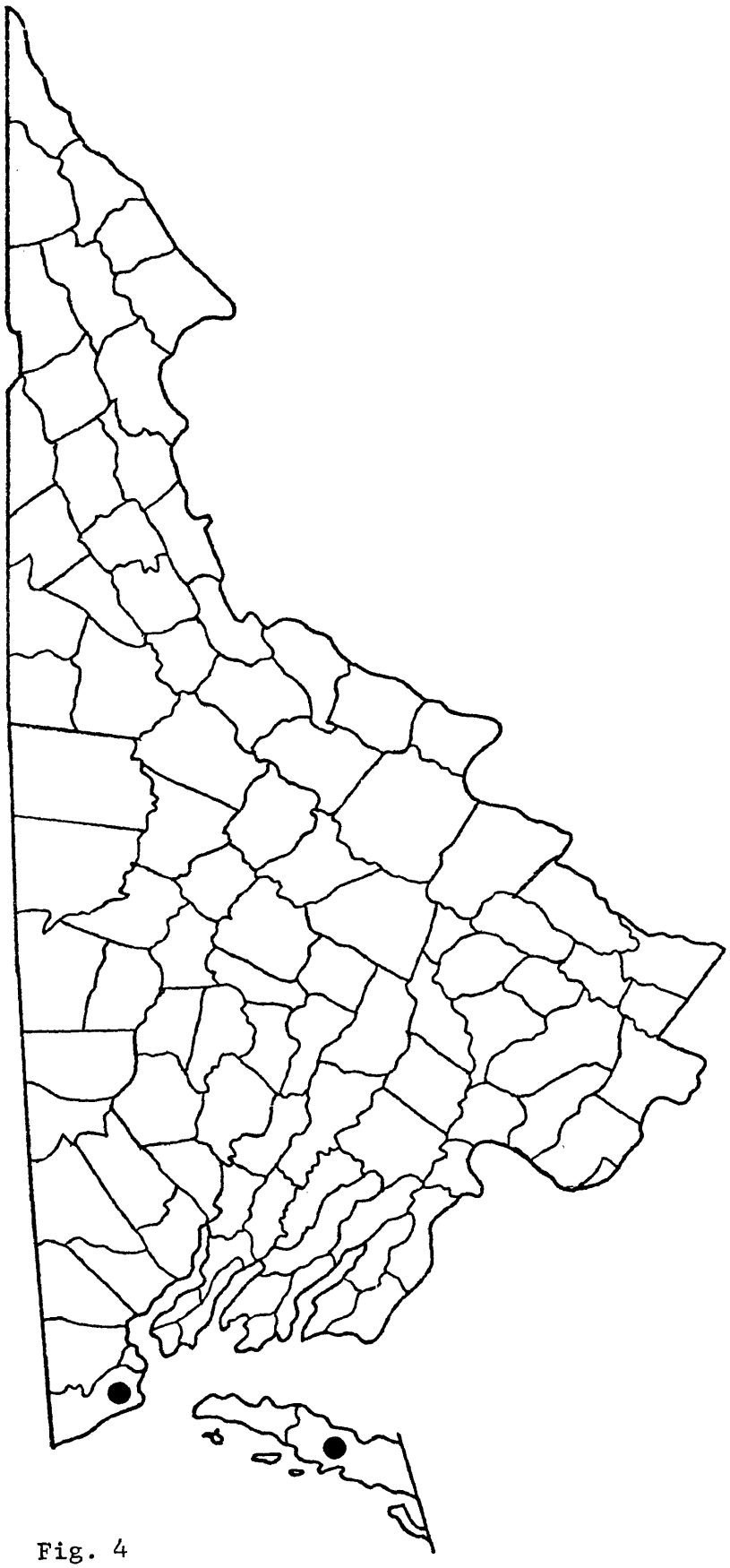


Fig. 4

like. Corolla tube white to violet, 2-4 mm long; corolla lobes 4, obovate, 4-5 mm long, 2 mm wide, acute, sometimes erose, ascending to spreading. Stamens 4; filaments 0.8-1.1 mm long; anthers 0.4-0.5 mm long. Stigma 2-lobed, oblong, 0.3 mm long; style 1.0 mm long. Fruit a capsule, globose, 5 mm long. Seeds light brown, 0.20-0.25 mm long, 0.15 mm wide, striate. March-May. Rich woods, river banks, moist thickets.

Specimens Examined

ALBEMARLE: Stevens 817 (FARM); AMELIA: Johnson 3235 (VCU); Lewis in 1936 (VPI); Lewis 181 (VPI); Lewis 374 (VPI); Peters 34 (VCU); AMHERST: Uttal in 1966 (LYN); Mitchell 20 (VCU); Young 4 (VCU); Thacker in 1966 (LYN); Young & Peace 7 (LYN); Freer in 1957 (LYN); ARLINGTON: Jones & Tompkins 77 (VPI); Martin in 1939 (NCU); BATH: Gupton 3795 (NCU); BEDFORD: Freer, Ramsey & Ivey 3616 (LYN, NCU, VPI); Freer, Ramsey, & Ivey 3607 (LYN, VPI); Freer in 1936 (LYN); Nolen 15 (LYN); Ramsey 44 (LYN); (2) in 1971 (RMWC); no data (RMWC); Smitherman in 1904 (RMWC); Penney & Tedford 104 (LYN); Waggoner & Irmischer in 1969 (LYN); Williams in 1960 (LYN); BOTETOURT: Freer 3757 (LYN, NCU, VPI); BRUNSWICK: Lewis 4058 (VPI); BUCHANAN: Music in 1970 (VPI); BUCKINGHAM: Chappell in 1972 (FARM); CAMPBELL: Daniel in 1938 (VPI); Harvill 33404 (FARM); CHARLES CITY: Ware & Via 4127 (WILLI, NCU); DICKENSON: in 1953 (VPI); FAIRFAX: Peoples 110 (GMUF); Shear in 1936 (VPI); FAUQUIER: Burkgren 360 (GMUF); FLOYD: Uttal 6878 (VPI); FLUVANNA: Diggs & Corcoran 1273 (WILLI); Diggs & Corcoran 1261 (WILLI); Massey in 1939 (VPI); FRANKLIN: Uttal 7818 (VPI); GILES: Straley in 1972 (VPI); GREENE: Wieboldt (WILLI); HANOVER: Wilkin 101 (FARM); Wells 381 (VCU); ISLE OF WIGHT: Fernald & Long 7145 (US);

Obolaria virginica L.

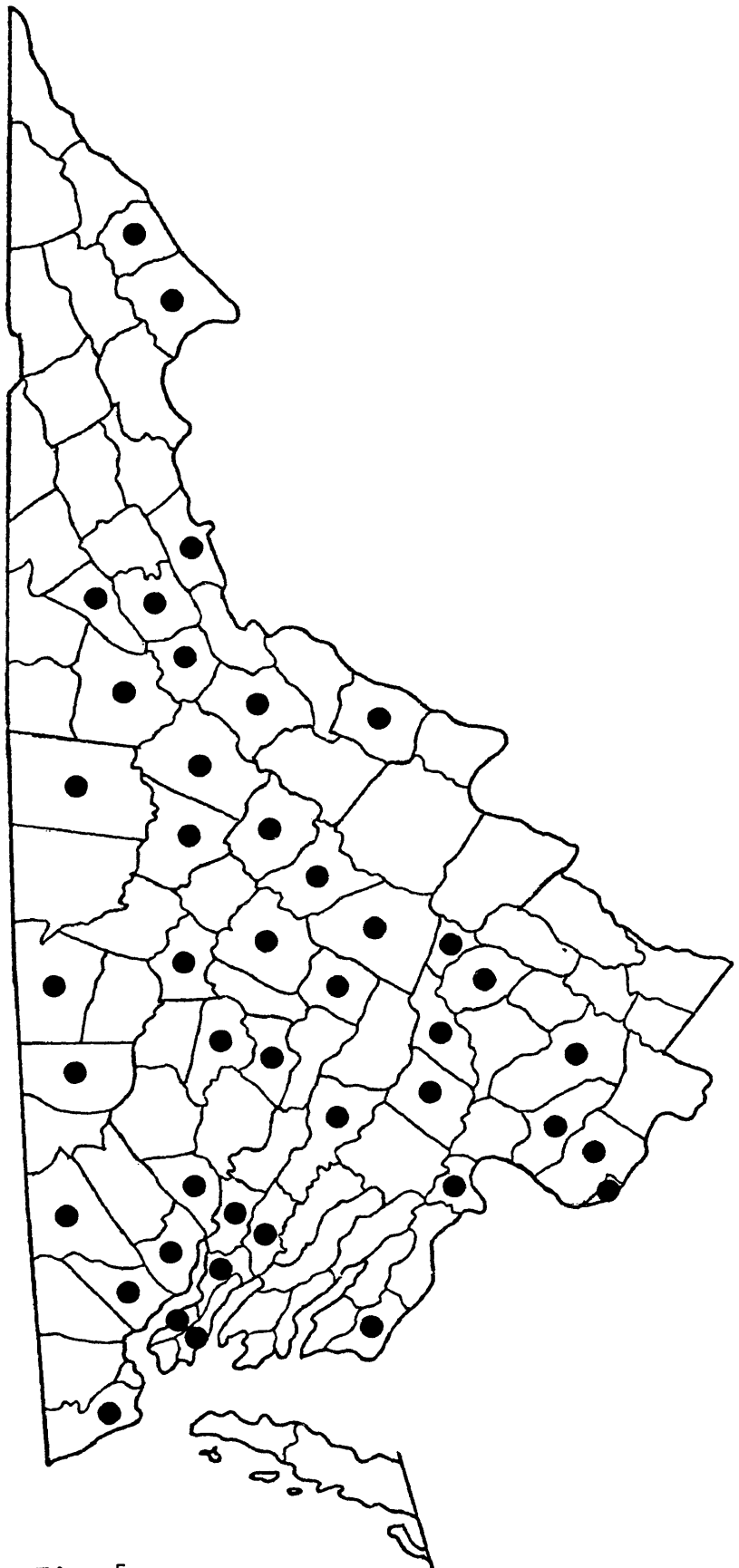


Fig. 5

JAMES CITY: Mikula 40 (FARM); Hall 3762 (WILLI, NCU); Barans 7 (WILLI); KING GEORGE: Harvill & Stevens 27802 (FARM); MADISON: Walker 2479 (US); MECKLENBURG: Seaman 6432 (NCU); MONTGOMERY: Massey 63 (VPI); NELSON: Massie in 1940 (LYN); Stevens 8353 (FARM); NEW KENT: Gillespie 471 (WILLI); NEWPORT NEWS: Lippincott in 1937 (VPI); Weiss 315 (VPI); NORTHUMBERLAND: Stevens 12481 (FARM); ORANGE: Stevens 4789 (FARM); PITTSYLVANIA: Chase in 1936 (NCU); Hathaway in 1968 (LYN); Ruska in 1968 (NCU); POWHATAN: Corcoran & Diggs 503 (WILLI); PRINCE EDWARD: Stevens in 1934 (FARM); PRINCE GEORGE: Townsend in 1939 (VPI); Stevens in 1934 (FARM); PRINCE WILLIAM: Allard 2779 (US); ROANOKE: Sherertz 2 (VCU); SOUTHAMPTON: Fernald, Long, and Pease 11719 (US); SPOTSYLVANIA: Stevens 3165 (FARM); SURRY: Harvill 23618 (FARM); VIRGINIA BEACH: Miller in 1903 (US); YORK: Kirkman & Kirkman 870 (WILLI); Kline 13 (WILLI); Weiss 736 (VPI).

BARTONIA Muhl. ex Willd.

Slender, erect to twining, annual herbs. Leaves appressed, alternate or opposite, scale-like. Inflorescence cymose. Calyx tube not well-developed; calyx lobes 4. Corolla tube not well-developed; corolla lobes 4. Stamens 4, inserted on corolla tube, alternating with corolla lobes. Stigma 2-lobed, style very short. Fruit a capsule. Seeds numerous, ellipsoid.

KEY TO BARTONIA

Scale-like leaves opposite; corolla lobes oblong, mucronate, usually erose. . . . . B. virginica

Scale-like leaves alternate; corolla lobes lanceolate, acuminate, margins entire . . . B. paniculata

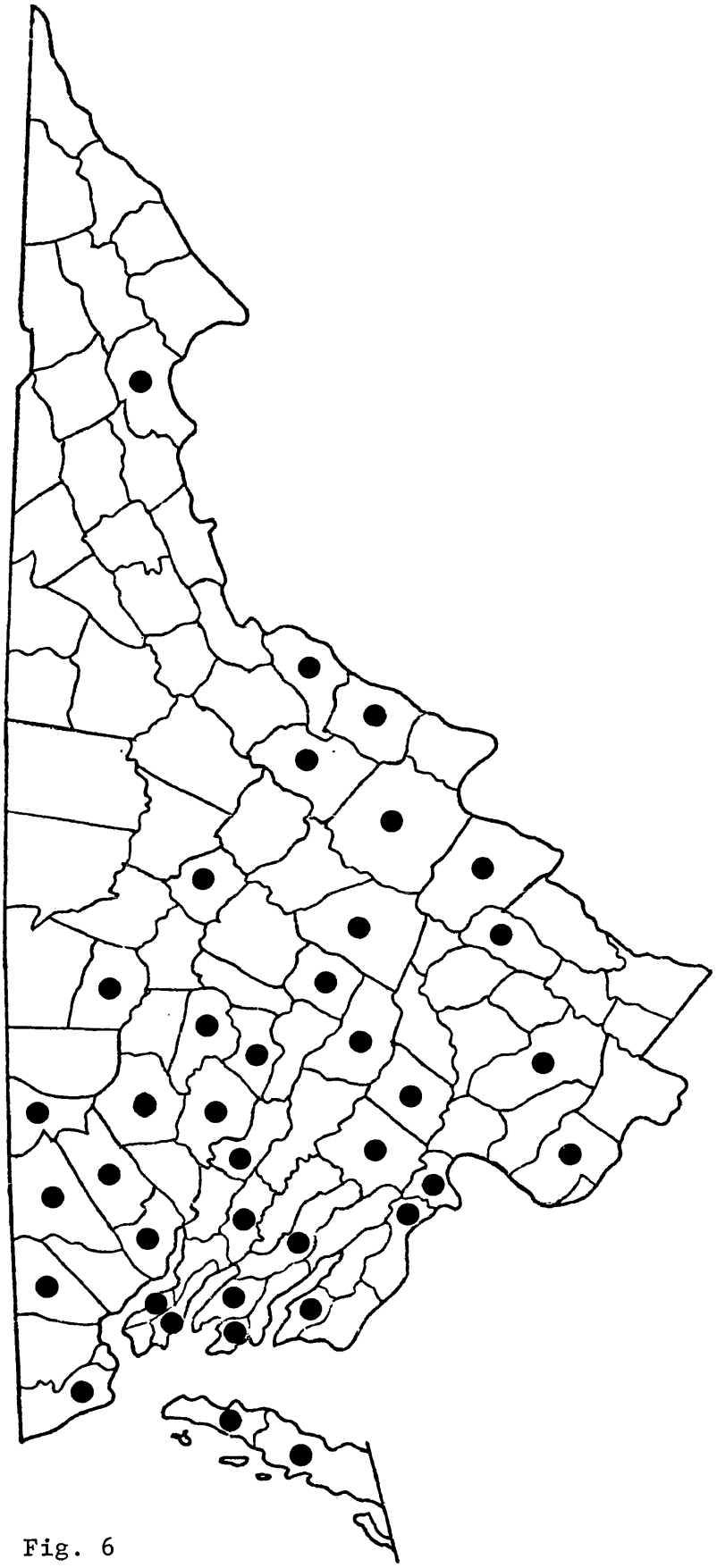
Bartonia virginica (L.) BSP., Prel. Cat. N.Y. Pl. 36. 1888.

Sagina virginica L., Sp. Pl. 2: 128. 1753.
Bartonia tenella Muhl. ex Willd., Ges. Naturf. Freunde Berlin, Neue Schrift 3: 444. 1801.
Centaurella autumnalis Pursh, Fl. Am. Sept. 1: 100. 1814.
Centaurella moseri Steudel & Hochstein ex Griseb., Gen. et Sp. Gent. 308. 1839.
Bartonia moseri (Steud. & Hochst. ex Griseb.) Robins & Schrenk ex Gilg, Engl. & Prantl Nat. Pflanzenf. 4. 2: 76. 1895.

Annual herb. Stem 0.4-3.0 dm tall, simple or branched above, slender, wiry, usually slightly angled, often somewhat twisted; internodal distance decreasing basally with leaves becoming quite congested at base. Leaves simple, scale-like, subulate, 0.9-4.7 mm long, 0.2-1.3 mm wide, usually opposite, occasionally alternate near base of stem. Inflorescence cymose. Calyx tube not well-developed; calyx lobes 4, narrowly lanceolate, 2.0-3.5 mm long, 0.4-1.1 mm wide. Corolla tube greenish yellow, not well-developed; corolla lobes 4, yellow, oblong, 1.6-2.4 mm long, 0.75-1.2 mm wide, quite abruptly rounded at apex, mucronate, usually erose. Stamens 4, 1.5-3.5 mm long; anthers purplish, oblong, 0.6-1.2 mm long, minutely apiculate. Stigma lobes decurrent, 1.5-2.3 mm long; style persistent after capsule formation, 1.0-2.1 mm long. Capsule 4.0-5.5 mm long, dehiscing below the style. Seeds light brown, 0.1-0.2 mm long, 0.05-0.1 mm wide. July-Sept. Sphagnous bogs, margins of swamps, lake shores, wet acid soil.

Specimens Examined

ACCOMACK: Wieboldt 2123 (WILLI); ALBEMARLE: Stevens 1521 (FARM); ALLEGHANY: Stevens & Davenport 7331 (FARM); AMELIA: Lewis 1641 (VPI); APPOMATOX: Harvill in 1969 (FARM); AUGUSTA: Freer, Ramsey, & Baxter



Bartonia virginica (L.) BSP.

Fig. 6

12117 (LYN); Freer & Ramsey 3996 (LYN, NCU); Harvill, Stevens, & Carr 26436 (FARM); Stevens 11311 (FARM); Freer & Stevens 3235 (LYN, VPI); Rawlinson 62A (VPI); BATH: Wheeler in 1907 (US); CAROLINE: Harvill 22091 (WILLI, ODU); Harvill 22733 (FARM); CHESTERFIELD: Stevens & Davenport 1798 (FARM); Blood 34 (VCU); Parker in 1974 (VCU); Hopkins in 1946 (VPI); DINWIDDIE: Harvill 19986 (NCU); Harvill & Harvill 32568 (FARM); Kral 13176 (VPI); FAIRFAX: Bradley 4508 (GMUF); Bradley 4233 (GMUF); FAUQUIER: Hermann 9905 (US); FLUVANNA: Stevens 4101 (FARM); Diggs & Diggs 605 (WILLI); GLOUCESTER: Harvill 13444 (FARM); Greaves 600 (WILLI); GREENSVILLE: Harvill 20851 (NCU); Harvill 19942 (FARM); HENRICO: Harvill 24460 (FARM); KING & QUEEN: Harvill 22370 (WILLI, FARM); KING GEORGE: Harvill & Stevens 29138 (FARM); LANCASTER: Harvill 26877 (FARM); LOUISA: Wieboldt 713 (WILLI); Stevens 5478 (FARM); LUNENBURG: Harvill 29288 (FARM); MATHEWS: Harvill 13232 (FARM, NCU); NEW KENT: Soltis 570 (WILLI); NEWPORT NEWS: G.C.M. in 1935 (VPI); Appler 814 (WILLI, NCU); NORTHAMPTON: Hunnewell 16954 (VPI); Fernald & Long 5419 (FARM); PAGE: Artz in 1968 (FARM, LYN); POWHATAN: Stevens & Wieboldt 5674 (FARM); ROCKBRIDGE: Stevens & Wieboldt 13317 (FARM); ROCKINGHAM: Stevens & Carr 7716 (FARM); SPOTSYLVANIA: Stevens & Wieboldt 5861 (FARM); Wieboldt & Stevens 1205 (WILLI); SOUTHAMPTON: Mikula 2745 (FARM, WILLI); Ahles & Baird 57500 (NCU); SUFFOLK: Mikula 2776 (WILLI, FARM); Kral 11063 (VPI); SURRY: Ware 5680 (WILLI); SUSSEX: Harvill 22954 (FARM); TAZEWELL: Musselman 2935 (FARM); VIRGINIA BEACH: Fernald & Long 4136 (VPI); WESTMORELAND: Harvill & Stevens 29097 (FARM); YORK: Mikula 7405 (FARM).

Bartonia paniculata (Michx.) Muhl., Cat. 16. 1813.

Bartonia paniculata (Michx.) Muhl.

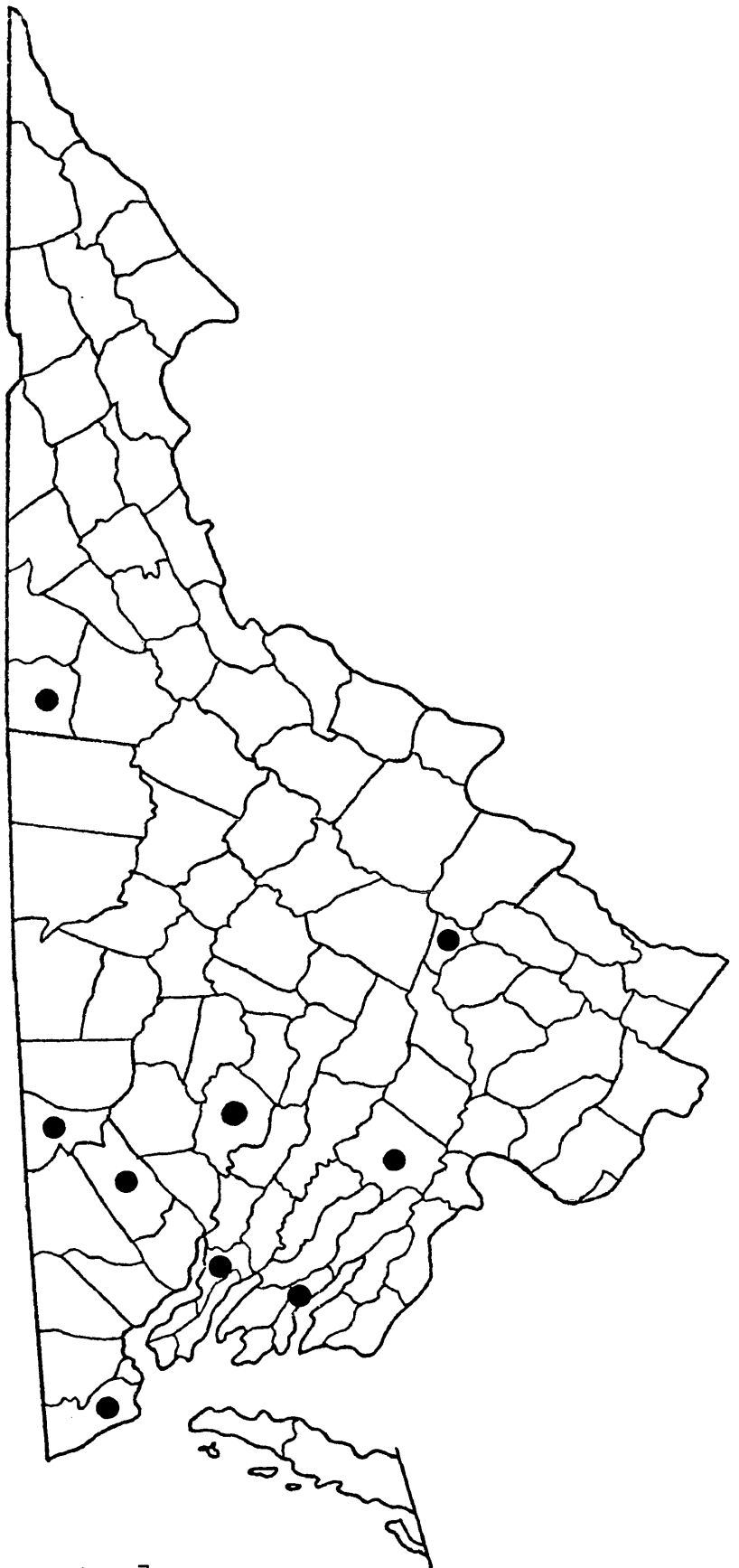


Fig. 7

Centaurium autumnale Pers., Syn. Pl. 1: 137. 1805.
Bartonia tenella βbrachiata (Muhl. ex Willd.) Wood, Class-book, ed. 2. 586. 1866.
Bartonia lanceolata Small, Fl. S.E. U.S. 932, 1336. 1903.
Bartonia paniculata (Michx.) Robinson, Rhodora 10: 35. 1903.

Annual herb. Stem 0.4-4.0 dm tall, erect or twining, simple or branched above. Leaves simple, scale-like, subulate to narrowly lanceolate, 0.5-3.0 mm long, 0.2-1.1 mm wide, alternate. Inflorescence cymose. Calyx tube not well-developed; calyx lobes 4, lanceolate, 1.5-2.8 mm long, 0.5-1.0 mm wide. Corolla tube not well-developed; corolla lobes 4, white to cream-colored, lanceolate, 1.5-3.0 mm long, 1.0-1.5 mm wide, acuminate, margins entire. Stamens 4, 2.2-3.8 mm long; anthers yellow, 0.3-0.6 mm long, obtuse. Stigma lobes decurrent, 0.8-1.5 mm long; style persistent, 0.5-1.5 mm long. Capsule 3.5-5.8 mm long, dehiscing by seperation of the stigma lobes. Seeds light brown, 0.10-0.20 mm long, 0.07-0.15 mm wide. Late July-Sept. Sandy and sphagnous bogs, swamps, and wet open woods.

Specimens Examined

CAROLINE: Fernald & Long 7578 (US); CHESTERFIELD: Parker in 1974 (VCU); GREENE: Wieboldt 1248 (WILLI); GREENSVILLE: Fernald & Long 11116 (VPI); HENRY: Stevens 13198 (FARM); JAMES CITY: Fosberg in 1963 (US); MIDDLESEX: Train 666 (WILLI); SUSSEX: Hopkins in 1946 (VPI); VIRGINIA BEACH: Stevens 647 (FARM).

SABATIA Adanson

Annual, biennial, or perennial, erect, glabrous herbs; perennials either rhizomatous or arising from a caudex. Roots fibrous in annuals and biennials; wiry or somewhat fleshy in perennials. Leaves basal or

cauline, entire, sessile to clasping. Branching pattern opposite or alternate. Inflorescence cymose. Flowers perfect. Calyx gamosepalous; calyx lobes 5-12. Corolla rotate; corolla lobes 5-12, spreading. Stamens 5-12; anthers attached basally, dehiscence lateral through slits, becoming circinnately recurved after pollen discharge; filaments inserted on the corolla tube, alternating with the corolla lobes. Stigma 2-lobed; style simple. Fruit a capsule.

KEY TO *SABATIA*

Branching opposite.

- Lower half of stem quadrangular, winged.
  - Corolla lobes pink, rarely white; pedicels 1-4 cm long . . . . . *Sabatia angularis*
  - Corolla lobes white; pedicels 5-8 mm long. . . . . *Sabatia quadrangula*
- Lower half of stem terete, wingless.
  - Corolla lobes pink with greenish yellow eye spot at base of lobes . . . . . *Sabatia brachiata*
  - Corolla lobes white, no apparent eye spot at base of lobes . . . . . *Sabatia difformis*

Branching alternate.

- Flowers pentamerous; upper cauline leaves much reduced from lower cauline leaves.
  - Cauline leaves broadly sessile at base . . . . . *Sabatia campanulata*
  - Cauline leaves tapered at base . . . . . *Sabatia stellaris*
- Flowers pentamerous to plurimerous; upper and lower cauline leaves mostly equal in size.
  - Corolla lobes and calyx lobes 5-7 . . . . . *Sabatia calycina*
  - Corolla lobes and calyx lobes 7-12 . . . . . *Sabatia dodecandra*

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

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 forma albiflora Raf. ex House, Bull. N.Y. State Mus. 254: 566. 1924.
Sabatia angularis forma cleistantha Fern., Rhodora 42: 474. 1940.

Biennial herb. Stem quadrangular, the corners winged by thin membranes up to 0.5 mm wide, 3-5 dm tall. Roots wide-spreading, shallowly situated. Basal rosette either present or absent at anthesis; leaves spatulate to obovate, 1.5-4.0 cm long, 2.0-3.0 cm wide. Cauline leaves broadly ovate, almost cordate, 1.5-5.0 cm long, 1-4 cm wide, thin, with 5-7 nerves prominent underneath, acute, very strongly clasping the stem; uppermost cauline leaves broadly lanceolate, reduced in size, obtuse to acute. Branching opposite, ultimate branches occasionally alternate. Inflorescence of corymbosely-arranged cymules. Calyx tube 1-2 mm long, much exceeded in length by corolla tube; calyx lobes 5, linear, 0.4-1.5 cm long, 1.0-2.5 mm wide. Corolla tube 4-7 mm long; corolla lobes 5, pink (occasionally white), obovate to oblanceolate, 1-2 cm long, 4-7 mm wide, obtuse; irregular yellow or yellow-green eye spot outlined in red at base of corolla lobes. Anthers bright yellow, 3-5 mm long; filaments 2.5-4.5 mm long. Stigma lobes 2-6 mm long; style 4-6 mm long. Capsule cylindric, 5-10 mm long. Seeds blackish brown, 0.4-0.5 mm long. July-Aug. Open woods, fields, clearings, and roadsides.

Specimens Examined

ACCOMACK: Holmes in 1890 (US); ALBEMARLE: Mikula 7346 (WILLI); Stevens 376 (FARM); AMELIA: Lewis 857 (VPI); Lewis in 1936 (VPI); Johnson 3000 (VCU); AMHERST: Evermann in 1888 (US); (2) Bliss in 1972 (RMWC); Stevens 11267 (FARM); APPOMATTOX: Kral 11178 (NCU); AUGUSTA: Carr in 1936 (VPI); DeGarmis in 1939 (VPI); Massey in 1939 (VPI); Massey in 1947 (VPI); Swartzel in 1946 (VPI); BEDFORD: Bratten in 1907 (RMWC); Buhrman in 1908 (RMWC); Freer in 1966 (LYN); Henderson in 1930 (RMWC); Herbert in 1924 (RMWC); Paxton in 1908 (RMWC); Westall in 1908 (RMWC); BOTETOURT: Roane in 1969 (VPI); BRUNSWICK: Harvill & Harvill 32075 (FARM); Lewis 2910 (VPI); BUCKINGHAM: Harvill & Stevens 17329 (FARM); CAMPBELL: Daniel in 1938 (VPI); CHARLES CITY: Weiss 29 (VPI); CHARLOTTE: Harvill 22260 (FARM); Ramsey, Ruska, & Waggoner 8986 (NCU, VPI, LYN); Harvill 26409 (WILLI); CHESAPEAKE: Harvill 30217 (FARM); Mikula 2612-A (FARM, WILLI); Weiss 128 (VPI); CHESTERFIELD: Renner in 1970 (WILLI); Rice in 1970 (WILLI); Dolan 49 (VCU); Johnson 2900 (VCU, NCU); CULPEPPER: Kral 13478 (VPI); CUMBERLAND: Harvill 27252 (FARM); DINWIDDIE: Harvill 24101 (FARM); FAIRFAX: Bradley & Vasquez 8742 (WILLI); Hunnewell in 1918 (VPI); McAtee 3464 (VPI); Joosten 55 (VPI); Williams 20 (GMUF); Bradley, Shue, & Hurd 5781 (GMUF); Kral 13456 (VPI); Hammond & Soltis 790 (WILLI); FAUQUIER: Allard 7224 (VPI); Allard 2061 (VPI); Allard 5309 (VPI); FLOYD: Mikula 3494 (FARM); FLUVANNA: Stevens 5968 (FARM); Diggs & Diggs 611 (WILLI); GILES: Straley 250 (NCU, VPI, LYN); GLOUCESTER: Greaves 648 (WILLI); Harley 2336 (FARM); GREENE: Harlow 1427 (VPI); Wieboldt 1126 (WILLI); HALIFAX: Ramsey, Ruska, Waggoner, & Ramsey 8931 (NCU, LYN); Harvill 26350 (FARM); HANOVER: Corbett in 1963 (ODU); HENRY: Mikula

6971 (WILLI, FARM); ISLE OF WIGHT: Hammond 785 (WILLI); JAMES CITY: Barans 420 (WILLI, NCU); Loetterle 158 (WILLI); Loetterle 293 (WILLI); Loetterle 251 (WILLI); Mikula 2900 (WILLI, FARM); Massey in 1936 (VPI); LANCASTER: Stanley & Miller in 1973 (GMUF); LOUDON: Miller & Stanley in 1974 (GMUF); LOUISA: Stevens 4185 (FARM); LUNENBURG: Ramsey, Ruska, Waggoner, & Hansrote 9584 (NCU, LYN); MATHEWS: Smith in 1956 (VPI); MECKLENBURG: Seaman 3623 (NCU); Lindzey in 1956 (VPI); Harvill & Harvill 25945 (FARM); MONTGOMERY: Harvill 14962 (FARM); Overton in 1948 (VPI); Massey in 1935 (VPI); Massey in 1956 (VPI); Smyth in 1891 (VPI); NELSON: Stevens & Davenport 319 (FARM); Ramsey, Ruska, & Waggoner 9385 (VPI, NCU, LYN); NEW KENT: Mikula 3123 (FARM); Soltis 438 (WILLI); Gillespie 224 (WILLI); NEWPORT NEWS: Appler & Hall 205 (WILLI); Appler 799 (WILLI, NCU); Ware 4352 (WILLI, NCU); G. C. M. in 1932 (VPI); NORFOLK: Churchill in 1927 (US); NORTHUMBERLAND: Knowlton in 1897 (US); Bradley & Vasquez 8902 (GMUF); NOTTOWAY: Ramsey, Hooks, & Baxter 11037 (LYN, VPI); PAGE: F. W. H. in 1953 (VPI); PATRICK: Critz in 1940 (VPI); PITTSYLVANIA: Hathaway in 1962 (LYN); Hathaway in 1968 (LYN); Ruska & Waggoner in 1968 (NCU); Ahles & James 62222 (NCU); POWHATAN: Stevens & Wieboldt 5629 (FARM); Corcoran & Diggs 1256 (WILLI); Johnson 3494 (VCU); PRINCE EDWARD: Harvill 17383 (FARM, NCU); PULASKI: F. S. H. in 1909 (VPI); ROANOKE: Uttal 6655 (NCU, LYN, VPI); ROCKBRIDGE: Freer in 1935 (LYN); ROCKINGHAM: Steele in 1918 (US); SHENANDOAH: Hunnewell in 1946 (VPI); Artz 212 (VPI); Stevens 7879 (FARM); SPOTSYLVANIA: Wieboldt & Stevens 1196 (WILLI); STAFFORD: Hammond 789 (WILLI); SURRY: Mikula 3842 (FARM); Ware 5552 (WILLI); Ware 5512 (WILLI); Hammond 786 (WILLI); TAZEWELL: Music in 1970 (VPI); Music in 1970 (VPI); Harvill 26747 (FARM); VIRGINIA BEACH: Heller

Sabatia angularis (L.) Pursh

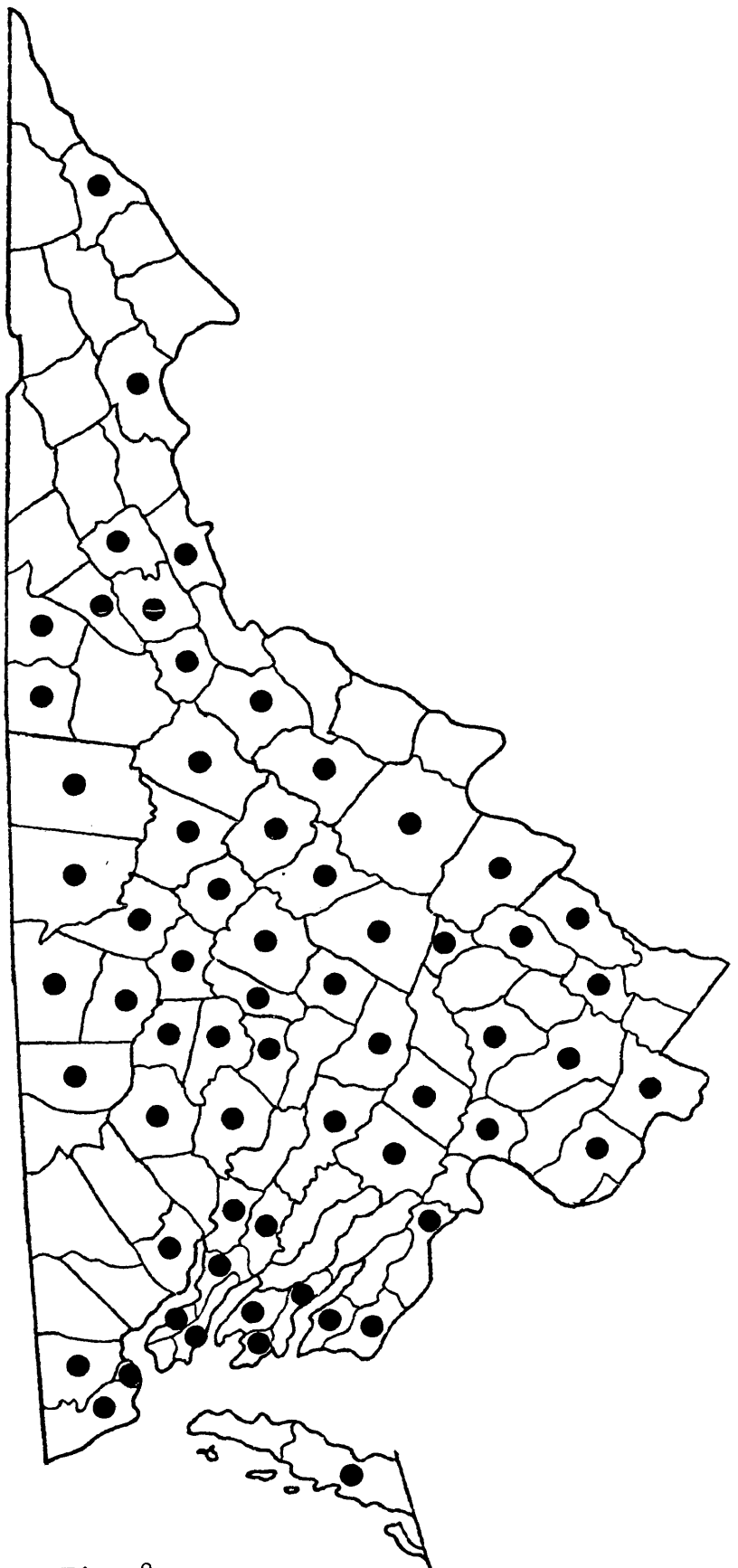


Fig. 8

1329 (US); Chamberlain in 1947 (VPI); Massey in 1936 (VPI); Bagley (ODU); WARREN: Krouse in 1974 (NCU); WESTMORELAND: Stevens & Harvill 29065 (FARM); WISE: Culbertson in 1946 (VPI); YORK: Kirkman 307 (WILLI); Mikula 7570 (WILLI, FARM).

Sabatia quadrangula Wilbur, Rhodora 57: 22. 1955.

Sabbatia cymosa G. Don, Gen. Hist. 4: 207. 1838.
Sabbatia paniculata Michx., Fl. Bor.-Am. 1: 146. 1803.
Sabatia brachiata forma candida Fern., Rhodora 39: 443. 1937.

Herbaceous annual. Stem quadrangular, often slightly winged, 2.5-4.5 dm tall. Roots numerous, spreading and shallowly situated. Basal rosette often present at anthesis, leaves obovate, 2-4 cm long, 1-2 cm wide, obtuse. Cauline leaves oblong, 0.8-5.0 cm long, 0.3-1.8 cm wide, acute, with a strongly clasping base. Branching opposite, ultimate branching occasionally alternate. Inflorescence of corymbosely-arranged cymules; pedicels very short, 1-2 mm long, giving flowers a sessile appearance. Calyx tube 1-3 mm long; calyx lobes 5, narrowly linear, 2-10 mm long, 0.5 mm or less wide. Corolla tube 3-5 cm long; corolla lobes 5, white becoming suffused with saffron upon drying, spatulate or elliptic, 5-12 mm long, 2-5 mm wide, obtuse; yellow eye spot may or may not be present at base of corolla lobes. Anthers pale yellow, 1.5-3.0 mm long; filaments white, 2-4 mm long. Stigma lobes green, oblong, 1-5 mm long; style white, 0.5-1.5 mm long. Capsule cylindrical, 4.5-7.0 mm long. Seeds yellowish brown, 0.2-0.3 mm long. June-Sept. Dry savannas, fields, pinelands, sandhills, and pocosin borders.

Specimens Examined

CAMPBELL: Uttal in 1964 (LYN); CHARLES CITY: Ware 2491 (ODU, WILLI);

Sabatia quadrangula Wilbur

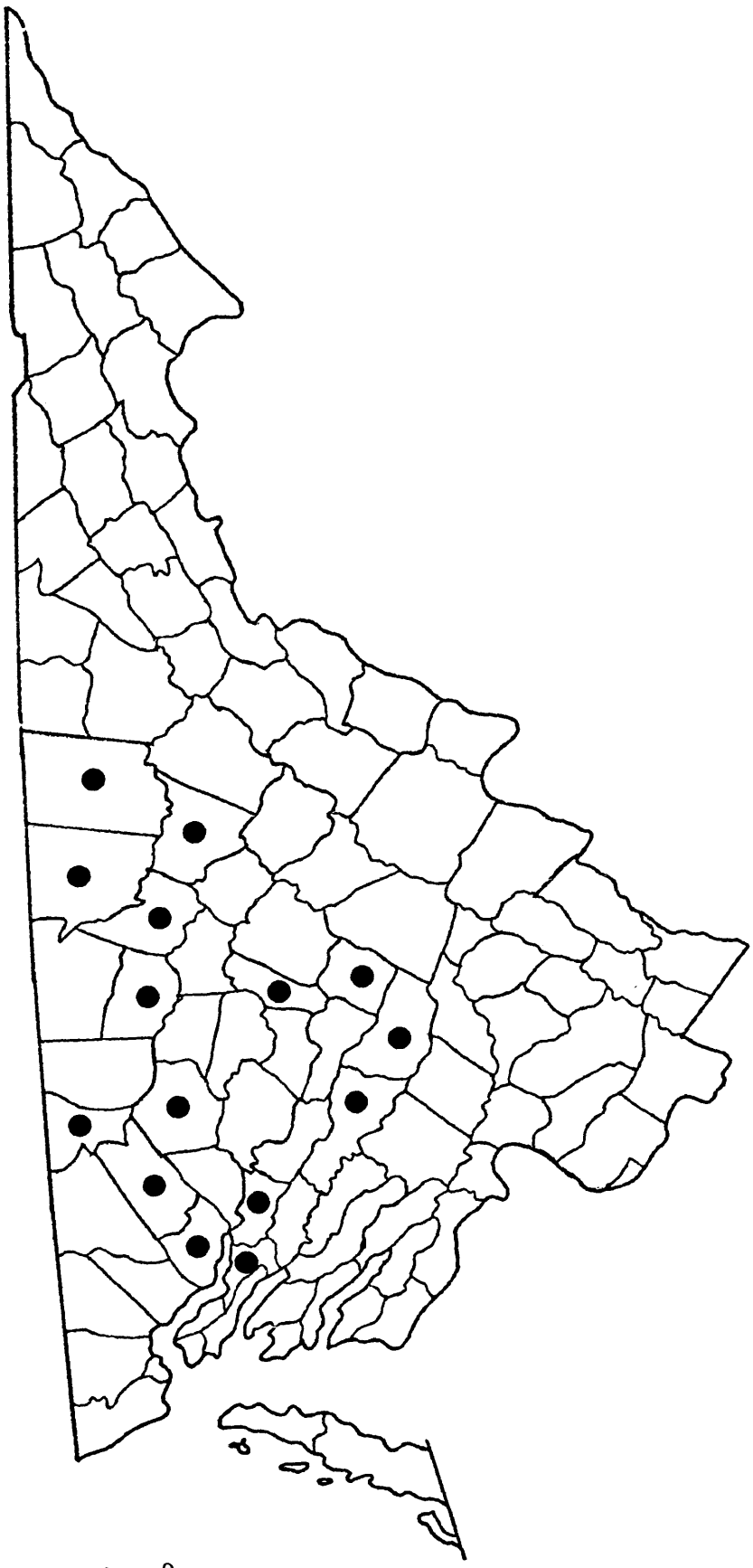


Fig. 9

Ware & Demaree 6357 (WILLI); Mikula 2256 (WILLI, FARM); CHARLOTTE: Ahles & James 61033 (NCU); Harvill 22259 (WILLI, FARM); CUMBERLAND: Harvill 27252 (FARM); DINWIDDIE: Harvill 17457 (FARM); FLUVANNA: Stevens 5968 (FARM); GREENSVILLE: Meyncke in 1904 (US); HALIFAX: Harvill 25889 (FARM); HANOVER: Svenson 272 (FARM); Ward in 1885 (US); JAMES CITY: Harvill 11419 (FARM); Freer in 1967 (LYN); Mikula 3048 (WILLI); LOUISA: Wieboldt 700 (WILLI); Stevens in 1971 (FARM); LUNENBURG: Ramsey, Ruska, Waggoner, & Hansrote 9660 (NCU, LYN); Harvill 28829 (FARM); PITTSYLVANIA: Hathaway in 1963 (LYN); Hathaway in 1965 (LYN); Hathaway in 1966 (LYN); Hathaway in 1968 (LYN); SURRY: Mikula 3842 (WILLI); SUSSEX: Harvill & Harvill 33152 (FARM); Mikula 2197 (WILLI); Mikula 2205 (WILLI).

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

Chironia angularis var. angustifolia Michx., Fl. Bor.-Am. 1: 147. 1803.
Sabbatia concinna Wood, Class-Book ed. 2. 451. 1847.
Sabbatia angustifolia (Michx.) Britt., Mem. Torr. Club 5: 259. 1889.

Herbaceous annual. Stem 2.5-5.0 dm tall; lower stem terete to finely ridged; upper stem quadrangular. Roots numerous, slender, fibrous. Basal rosette present at time of flowering, leaves spatulate, 1.5-3.0 cm long, 1.0-1.4 cm wide, obtuse. Cauline leaves oblong, 1-4 cm long, 3-10 mm wide, apiculate, tapering slightly at base, not broadly clasping. Branching opposite. Inflorescence of corymbosely-arranged cymules; pedicels 2-8 mm long. Calyx tube 1.5-3.0 mm long; calyx lobes 5, linear, 7-10 mm long, 0.3-1.0 mm wide. Corolla tube greenish, 4-5 mm long; corolla lobes 5, pale pink to rose, oblong or spatulate, 7-14 mm long, 3-6 mm wide, obtuse; triangular, greenish yellow eye spot outlined in red at base of corolla lobes. Anthers bright yellow, 3 mm long; filaments pale yellow, 2-3 mm long. Stigma lobes 3-5 mm long; style 2-4 mm long. Capsule cylindrical,

Sabatia brachiata Ell.

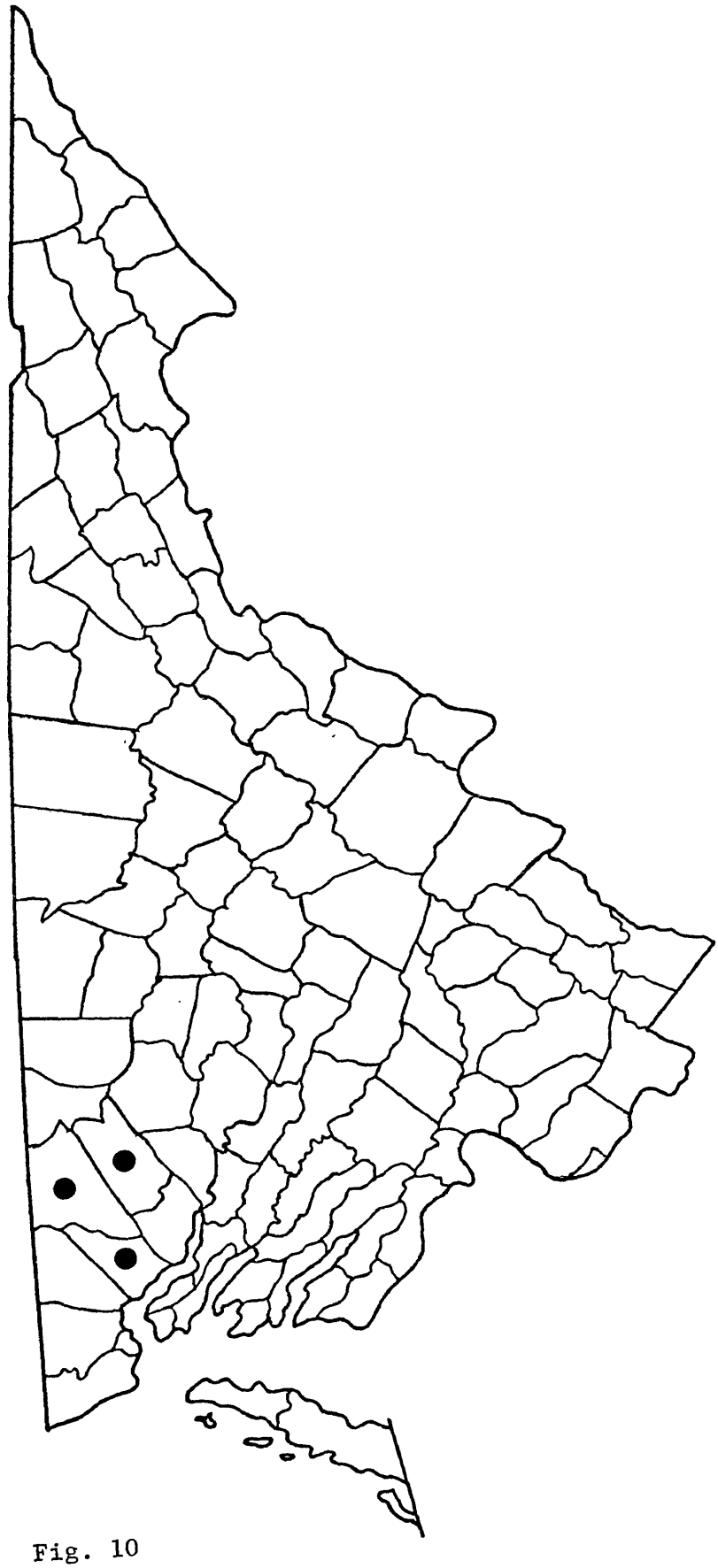


Fig. 10

3-5 mm long. Seeds black, 0.4-0.5 mm long. Late May-July. Dry oak woods, pine barrens, sandhills, and savannas.

Specimens Examined

ISLE OF WIGHT: Harvill 17069 (FARM), NCU); SOUTHAMPTON: Harvill & Harvill 25834 (FARM); SUSSEX: Fernald & Long 6344 (US); Ahles & Baird 58523 (NCU); Hammond 782, 783 (WILLI).

Sabatia difformis (L.) Druce, Bot. Exch. Club & Soc. Brit. Is. 3: 423. 1914.

Swertia difformis L., Sp. Pl. 1: 226. 1753.
Chironia lanceolata Walt., Fl. Car. 95. 1788.
Chironia cymosa Lam., Tabl. Encyc. et Meth. Bot. 1: 479. 1791.
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 var. latifolia Pursh, l. c.
Sabbatia paniculata var. angustifolia Pursh, l. c.
Sabbatia corymbosa Baldw. ex Ell., Sk. Bot. S.C. & Ga. 1: 283. 1817.
Sabbatia corymbosa var. angustifolia Ell., l. c.
Sabbatia lanceolata Raf., Fl. Tell. 3: 30. 1837.
Sabbatia cymosa (Lam.) G. Don, Gen. Hist. 4: 207. 1838.
Sabbatia lanceolata (Walt.) T. & G., Man. ed. 1: 356. 1848.

Herbaceous perennial from a thick rhizome. Stem 4.5-8.0 dm tall, ridged above by fine lines. Roots numerous, fleshy. Basal rosette absent. Lower cauline leaves bractlike, oblong, 2-3 cm long, 0.2-0.9 cm wide; upper cauline leaves ascendent, linear to oblong, 1.8-5.0 cm long, 0.4-2.0 cm wide, acute, sessile to clasping. Branching opposite. Inflorescence of corymbosely-arranged cymules; pedicels 2-8 mm long. Calyx tube 1-2 mm long; calyx lobes 5, linear to subulate, 0.2-1.0 cm long, 0.5-1.0 mm wide. Corolla tube 3-5 mm long; corolla lobes 5 (the innermost flower in the central cymules occasionally 6-parted), white, often becoming suffused with saffron when dried, oblong to oblanceolate, 0.7-1.5 cm long, 2-7 mm wide; basal eye spot on corolla lobes absent. Anthers bright

Sabatia difformis (L.) Druce

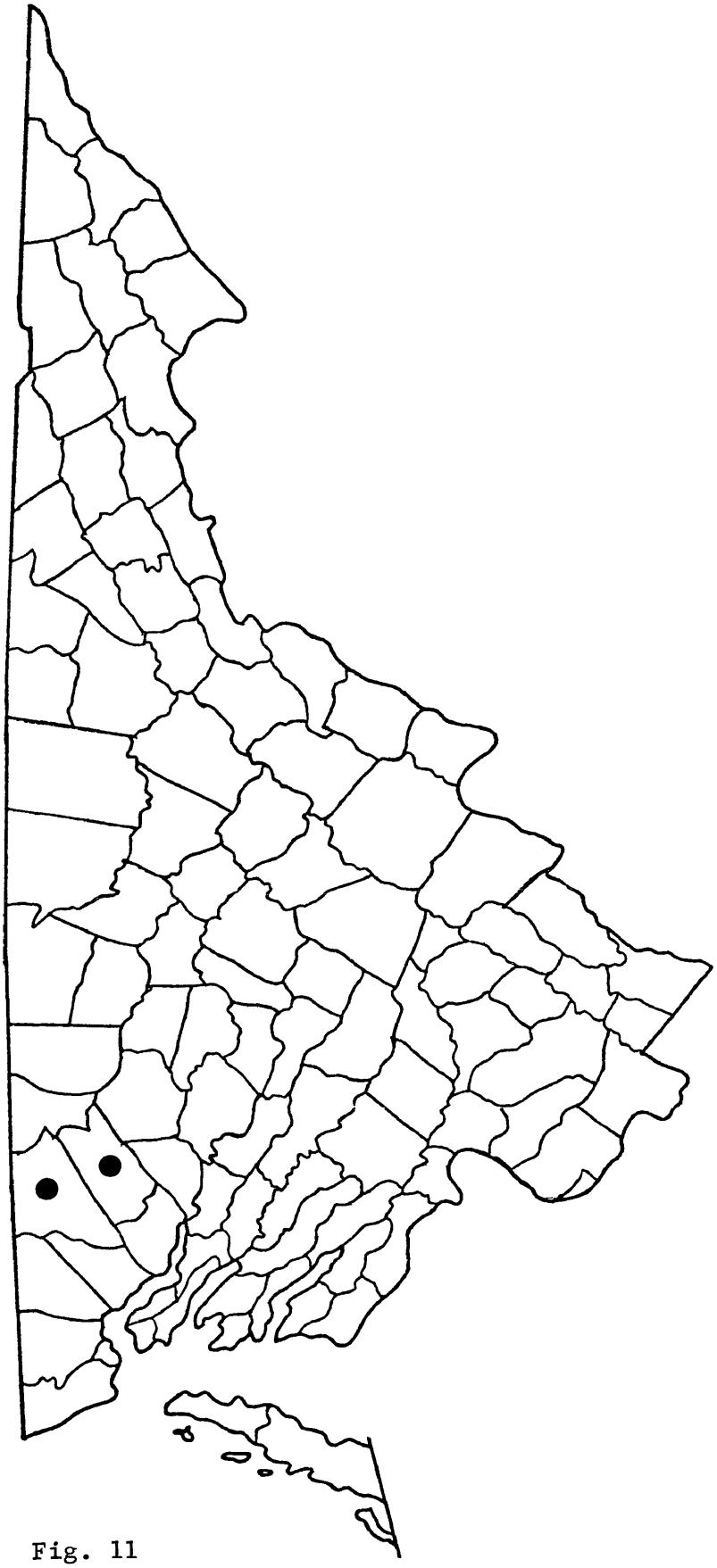


Fig. 11

yellow, 2-3 mm long; filaments white, 2-3 mm long. Stigma lobes 2-5 mm long; style 2-5 mm long. Capsule oblong, 4-8 mm long. Seeds brown, 0.4-0.5 mm long. July. Savannas, pine barrens, bogs, and pocosins on the Coastal Plain.

Specimens Examined

SOUTHAMPTON: Hathaway in 1967 (LYN); SUSSEX: Fernald, Long & Clement 15340 (US).

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

Chironia campanulata L., Sp. Pl. 1: 190. 1753.
Chironia gracilis Michx., Fl. Bor.-Am. 1: 146. 1803.
Chironia campanulata var. gracilis (Michx.) Pers., Syn. Pl. 1: 282. 1805.
Sabbatia gracilis (Michx.) Salisb., Parad. Lond. t. 32. 1806.
Sabbatia campanulata forma albina Fern., Rhodora 18: 151. 1916.
Sabbatia Tracyi Gandoger, Bull. Soc. Bot. Fr. 65: 61. 1918.
Sabbatia campanulata var. gracilis (Michx.) Fern., Rhodora 39: 444. 1937.

Herbaceous perennial from a short underground caudex. Stem 3-6 dm tall, terete. Basal rosette absent. Cauline leaves narrowly lanceolate, 1.5-4.5 cm long, 2-7 mm wide, acute, margins thickened, broadly sessile at base. Branching alternate. Inflorescence composed of solitary flowers; pedicels 4-7 cm long. Calyx tube 1.5-2.5 mm long; calyx lobes 5, linear, 0.7-1.7 cm long, 0.5 mm or less wide, typically nearly equal in length to the corolla. Corolla tube 3-5 mm long; corolla lobes 5, pink, or rarely, white, elliptic, 0.9-1.8 cm long, 4-9 mm wide, acute; unlobed yellow eye spot outlined in dull red at base of corolla lobes. Anthers bright yellow, 3-5 mm long; filaments pale yellow, 2-4 mm long. Stigma lobes 3-7 mm long; style 2-5 mm long. Capsule cylindrical, 5-7 mm long. June-Aug. Savannas and bogs of the Coastal Plain.

Sabatia campanulata (L.) Torr.

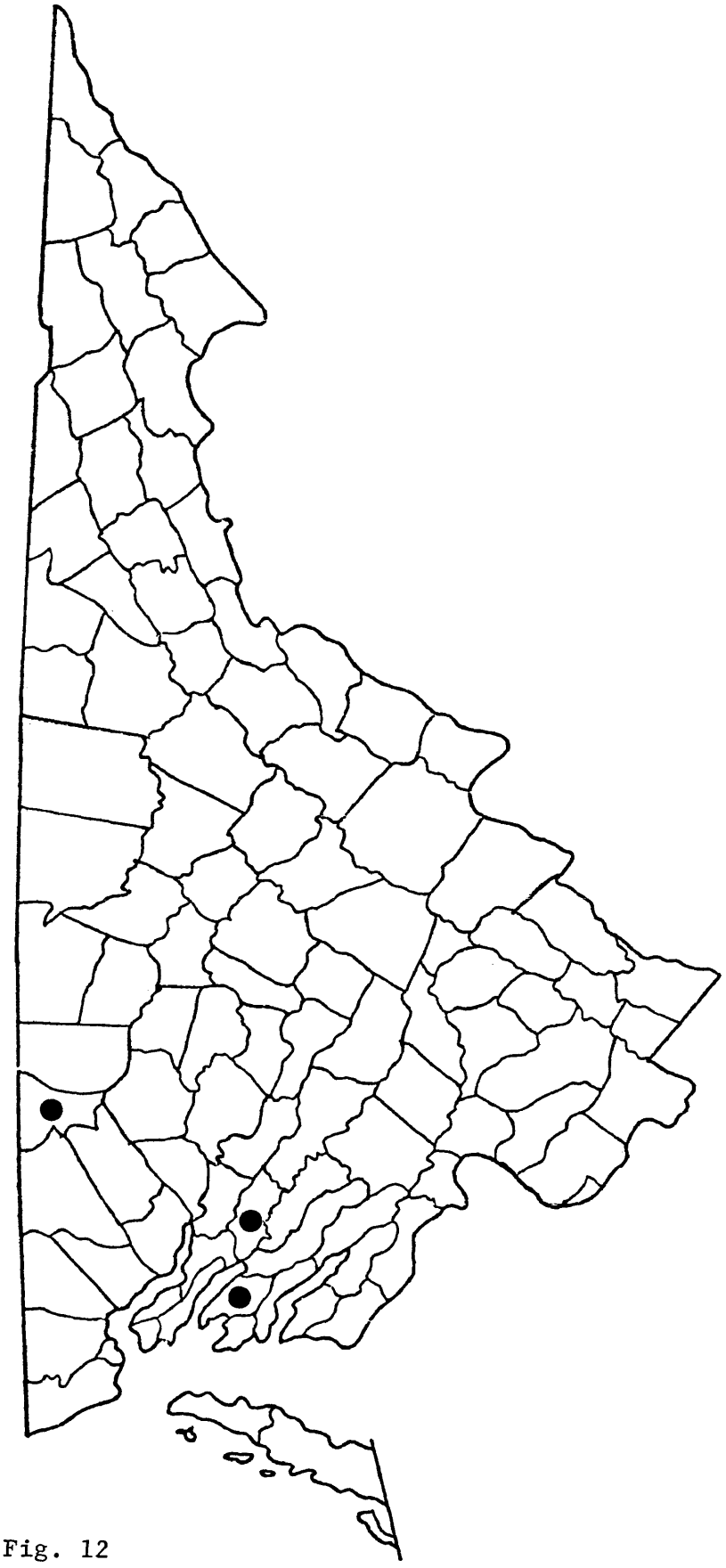


Fig. 12

Specimens Examined

GLOUCESTER: Harvill 13161 (NCU); Harvill 13133 (FARM); GREENSVILLE: Fernald & Long 13421 (US); NEW KENT: Mikula 3093 (FARM, WILLI).

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

Chironia amoena Raf., Med. Repos. II. 5: 359. 1808.
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 var. pumila A. Gray ex Griseb., Prodr. 9: 49. 1845.
Eustoma maculata Benth., Pl. Hartw. 292. 1848.
Sabbatia gracilis var. stellaris (Pursh) Wood, Am. Bot. & Flor. 267. 1870.
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 forma albiflora Britt., Bull. Torr. Club 17: 125. 1890.
Sabbatia simulata Britt., Bull. N.Y. Bot. Gard. 3: 448. 1905.
Sabbatia Purpusii Brandegee, Univ. Calif. Pub. Bot. 4: 275. 1912.
Sabatia amoena forma albiflora (Britt.) Fern., Rhodora 34: 26. 1932.
Sabbatia campanulata var. amoena (Raf.) Monachino, Torreya 41: 99. 1941.

Annual herb. Stem 1.5-5.0 dm tall, terete. Roots few to numerous, fibrous. Basal rosette absent. Cauline leaves thick, commonly darkened upon drying, 1-6 cm long, 1-8 mm wide, ascendent, apiculate, tapering at base; lower cauline leaves narrowly elliptic to linear; upper cauline leaves linear, quite narrow. Branching alternate. Inflorescence of loose and reduced cymules, flowers appearing solitary; pedicels 4-12 cm long. Calyx tube 2-4 mm long; calyx lobes 5, filiform, 6-20 mm long, 0.5 mm or less wide, usually much shorter than the length of the corolla, but occasionally equal to it. Corolla tube 4-6 mm long; corolla lobes 5, pink or white, elliptic to obovate, 1-2 cm long, 4-10 mm wide, obtuse; three-lobed yellow eye spot outlined in dull red present at the base of the corolla lobes. Anthers yellow, 3-4 mm long; filaments pale yellow to green, 2-3 mm long. Stigma lobes 3-8 mm long; style 2-4 mm long.

Sabatia stellaris Pursh

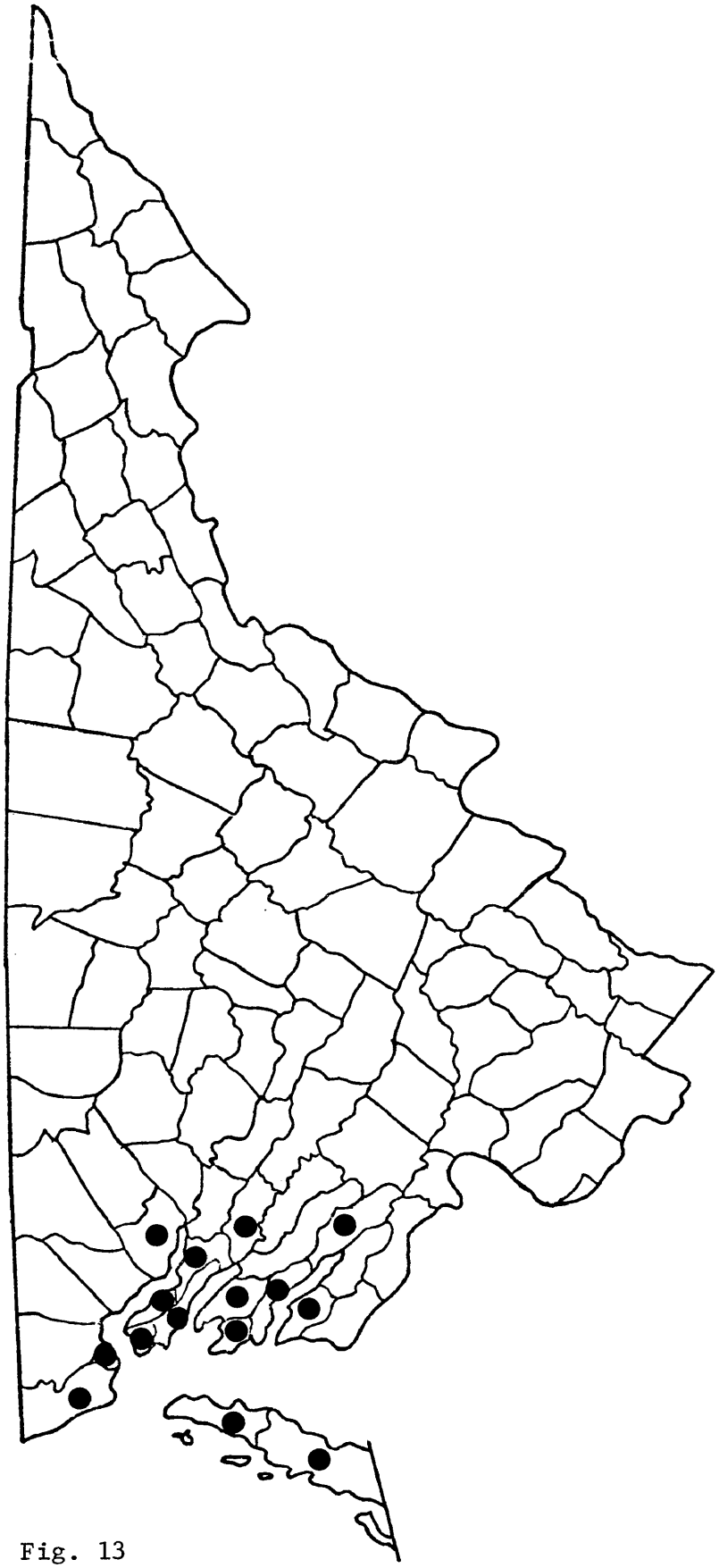


Fig. 13

Capsule globose, 6-8 mm long. Seeds brown, 0.3-0.4 mm long. July-Sept. Brackish marshes, sandy areas.

Specimens Examined

ACCOMACK: Freer in 1968 (LYN); Harvill 15791 (NCU); Harvill 15143 (FARM); Harvill 15206 (FARM); ESSEX: Fernald & Long 13422 (US); Hammond & Soltis 791 (WILLI); GLOUCESTER: Harvill 13478 (FARM); Hammond 787, 788 (WILLI); HAMPTON: in 1970 (FARM); Steele in 1895 (US); JAMES CITY: Loetterle 323 (WILLI); Newman in 1936 (VPI); LANCASTER: Stanley & Miller in 1973 (GMUF); MATHEWS: Harvill 11721 (FARM); MIDDLESEX: Hopkins in 1944 (VPI); NEW KENT: Mikula 3221 (FARM, WILLI); Soltis 356 (WILLI, NCU); NEWPORT NEWS: Harvill 11506 (FARM); Appler, Ware, & Rutledge 966 (WILLI); NORFOLK: Killip 6844 (US); NORTHAMPTON: Harvill & Wise 24707 (FARM); SURRY: no data (WILLI); Massey (VPI); VIRGINIA BEACH: Chamberlain in 1947 (VPI, NCU); Harvill & Wise 24523 (FARM); Mikula 3794 (FARM, WILLI); Fernald & Long 11113 (VPI); Massey in 1940 (VPI); Johnson 3711 (VCU); Straley 548 (VPI); Marshall in 1940 (NCU); YORK: Sallé 493 (WILLI, NCU); Weiss 416 (VPI).

Sabatia calycina (Lam.) A. Heller, Bull. Torr. Bot. Club 21: 24. 1894.

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' Bot. Mag. pl. 1600. 1813.
Sabbatia gracilis var. cubensis Griseb., Mem. Am. Acad. 11: 521. 1862.
Sabbatia dichotoma (Walt.) Trelease ex Branner & Coville, Ann. Rept. Geol. Surv. Ark. 1888. 4: 204. 1891.
Sabbatia cubensis Griseb., Urb. Symb. Ant. 8: 536. 1921.

Herbaceous perennial from a rhizome. Stems usually solitary, 1.5-4.0 dm tall. Roots slender, fibrous. Basal rosette absent. Cauline leaves

Sabatia calycina (Lam.) A. Heller

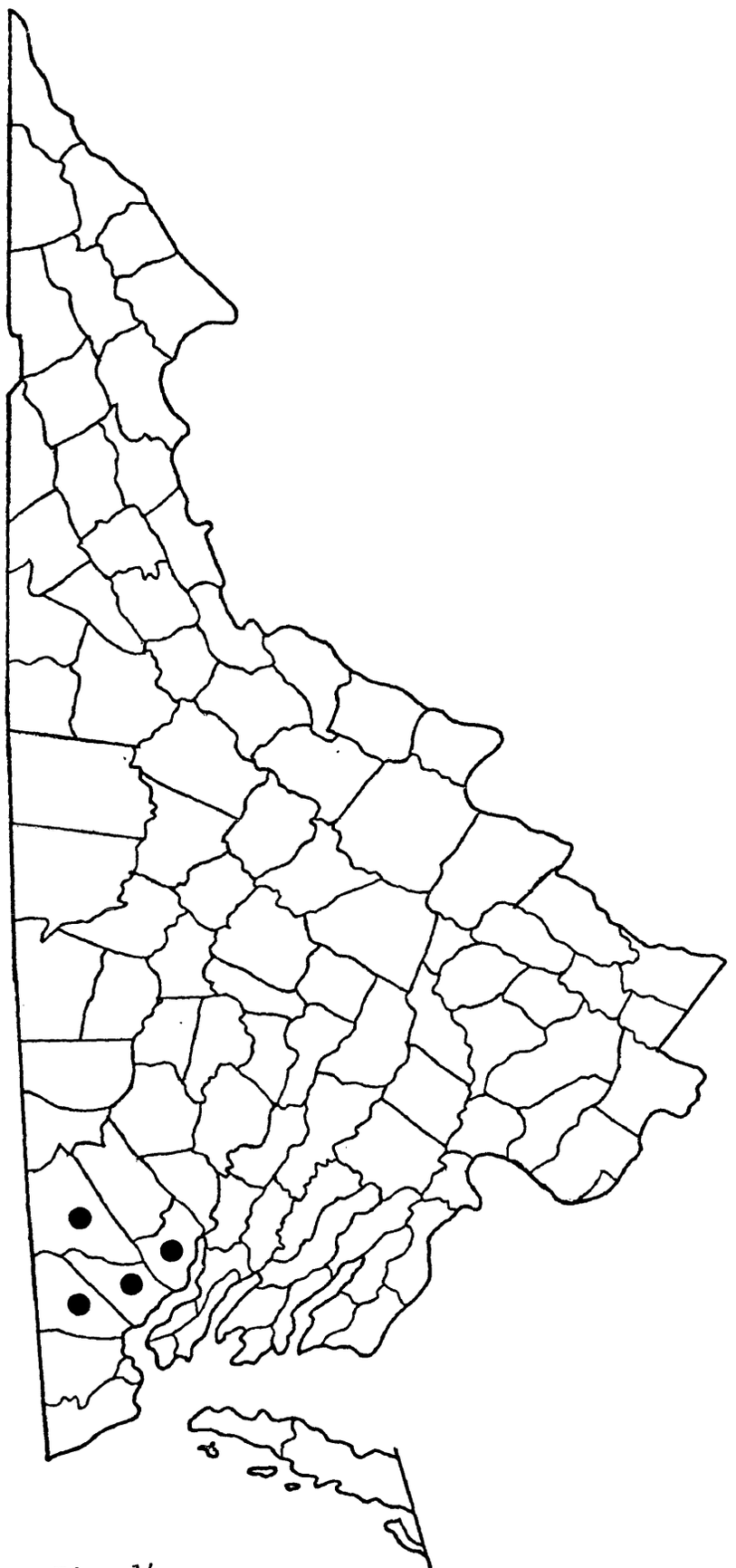


Fig. 14

spreading, elliptic to spatulate, 2.5-6.0 cm long, 0.8-1.8 cm wide, obtuse. Branching alternate. Inflorescence of 1-2-flowered cymules, flowers often appearing solitary; pedicels 2-5 cm long. Calyx tube 2-4 mm long; calyx lobes 5-7, oblanceolate, not all equal in size, often exceeding the corolla lobes by as much as twice their length, 1.0-2.5 cm long, 0.1-0.6 cm wide. Corolla tube 4-5 mm long; corolla lobes 5-7, pale pink, oblong to spatulate, 0.7-1.4 cm long, 3-5 mm wide, acute to obtuse; pale yellow triangular eye spot at the base of the corolla lobes. Anthers bright yellow, 2.5-3.5 mm long; filaments 2-3 mm long. Stigma lobes 4-6 mm long; style 1-2 mm long. Capsule spherical, 6-10 mm long. June-July. Ditches, riverbanks, cypress swamps, and swampy hardwoods.

Specimens Examined

ISLE OF WIGHT: Harvill 19810 (FARM); SOUTHAMPTON: Fernald & Long 13424 (US); Harvill 25834 (FARM); Mikula 8021 (WILLI); Mikula 7893 (WILLI); Fernald & Long 6348 (VPI); Hammond, Corcoran, & Diggs 784 (WILLI); SUFFOLK: Kearney 1726 (US); SURRY: Mikula 1554 (FARM).

Sabatia dodecandra (L.) BSP., Prel. Cat. N.Y. 36. 1888.

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.
Sabbatia chloroides (Michx.) Pursh, Fl. Am. Sept. 1: 138. 1814.
Pleienta leucantha Raf., New Fl. 4: 92. 1838.
Pleienta dodecandra (L.) Raf. ex B. D. Jackson, Ind. Kew. 2: 561. 1894.

Herbaceous perennial. Stems usually solitary, 3-7 dm tall, terete. Roots slender and wiry. Basal rosette absent. Cauline leaves lanceolate or elliptic, only very gradually reduced above, 2.5-6.0 cm long, 0.5-2.0 cm wide, obtuse to acute, sessile. Branching alternate. Inflorescence

Sabatia dodecandra (L.) BSP.

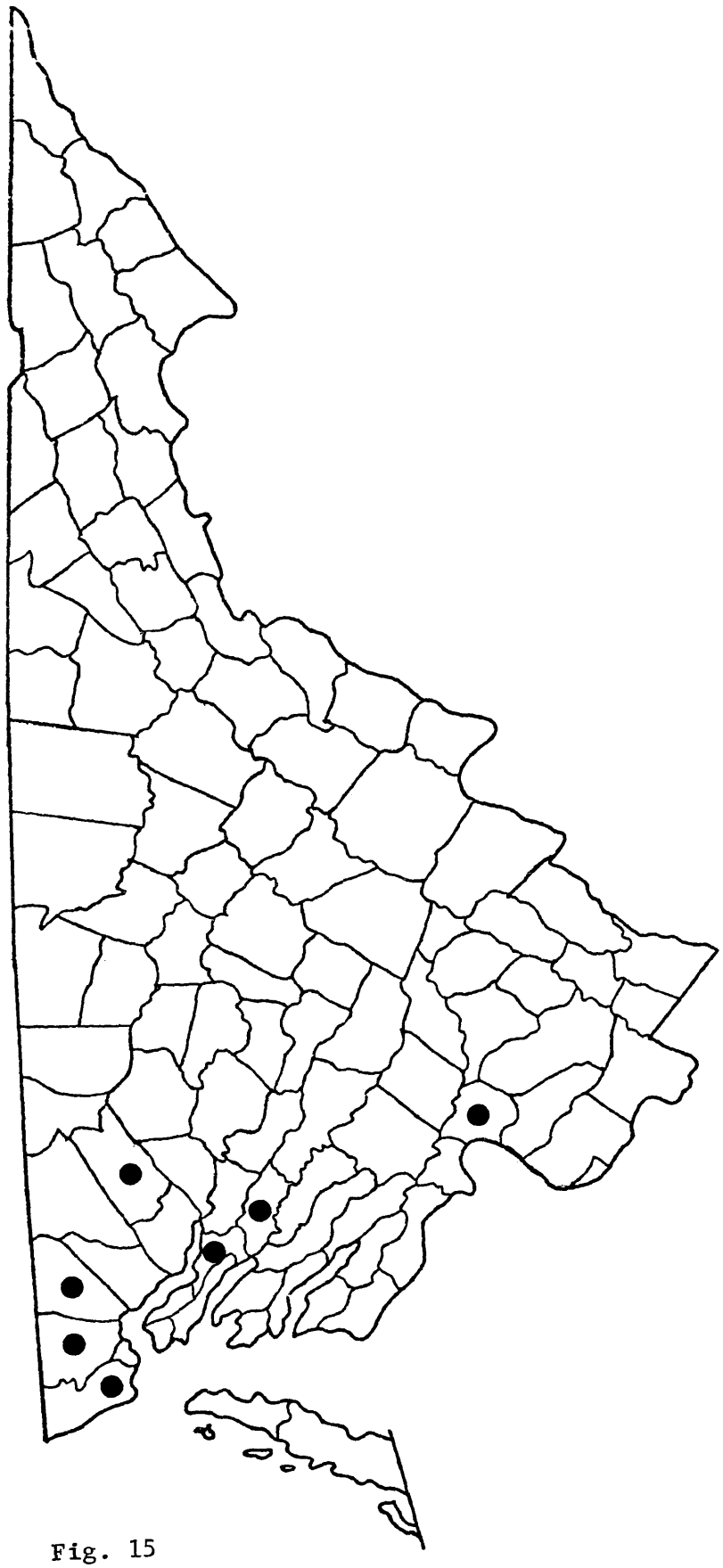


Fig. 15

of one to several one to two-flowered cymules, flowers appearing solitary; pedicels 3-8 cm long. Calyx tube 2-3 mm long; calyx lobes 7-12, linear to narrowly oblanceolate, 0.8-1.8 cm long, 1.0-2.5 mm wide, acute. Corolla tube 5-7 mm long; corolla lobes 7-12, pink or occasionally white, oblanceolate, 1.6-2.4 cm long, 5-8 mm wide, obtuse or acute; 3-lobed yellow eye spot outlined in red present at base of corolla lobes. Anthers bright yellow, 3-5 mm long; filaments yellow, 3-5 mm long. Stigma lobes 5-9 mm long; style 3-5 mm long. Capsule cylindrical, 6-10 mm long. Seeds brown, 0.4-0.5 mm long. June-Aug. Salt or brackish marshes.

Specimens Examined

CHESAPEAKE: Kearney 2377 (US); JAMES CITY: Loetterle (WILLI); Newman in 1936 (VPI); NEW KENT: Mikula 3222 (FARM, WILLI); STAFFORD: Svenson in 1963 (FARM, NCU); SUFFOLK: Fernald & Long 13423 (US); SUSSEX: Harvill & Harvill 26245 (FARM); VIRGINIA BEACH: Stevens 2452 (FARM); Massey no other data (VPI).

CENTAURIUM Hill

Centaurium pulchellum (Sw.) Druce, Ann. Scott. Nat. Hist. 242. 1907.

Gentiana pulchella Sw., Act. Holm. 1783: 84. 1783.
Gentiana ramossissima Vill., Hist. Pl. Dauph. 2: 530. 1787.
Erythraea ramossissima (Vill.) Pers. Syn I. 283. 1805.
Erythraea pulchella (Sw.) Fries, Novit. 74. 1828.
Centaurium pulchellum (Sw.) Hayek, Oesterr. Bot. Zeitschr. lvi. 70. 1906.

[1]Stem erect, 1-3 dm tall, typically much branched. Cauline leaves lance-ovate to oblanceolate, 1-2 cm long, 0.5-0.9 cm wide, sessile.

[1]Most of the information contained in the description of Centaurium pulchellum was obtained from Gleason & Cronquist (1963).

Centaurium pulchellum (Sw.) Druce

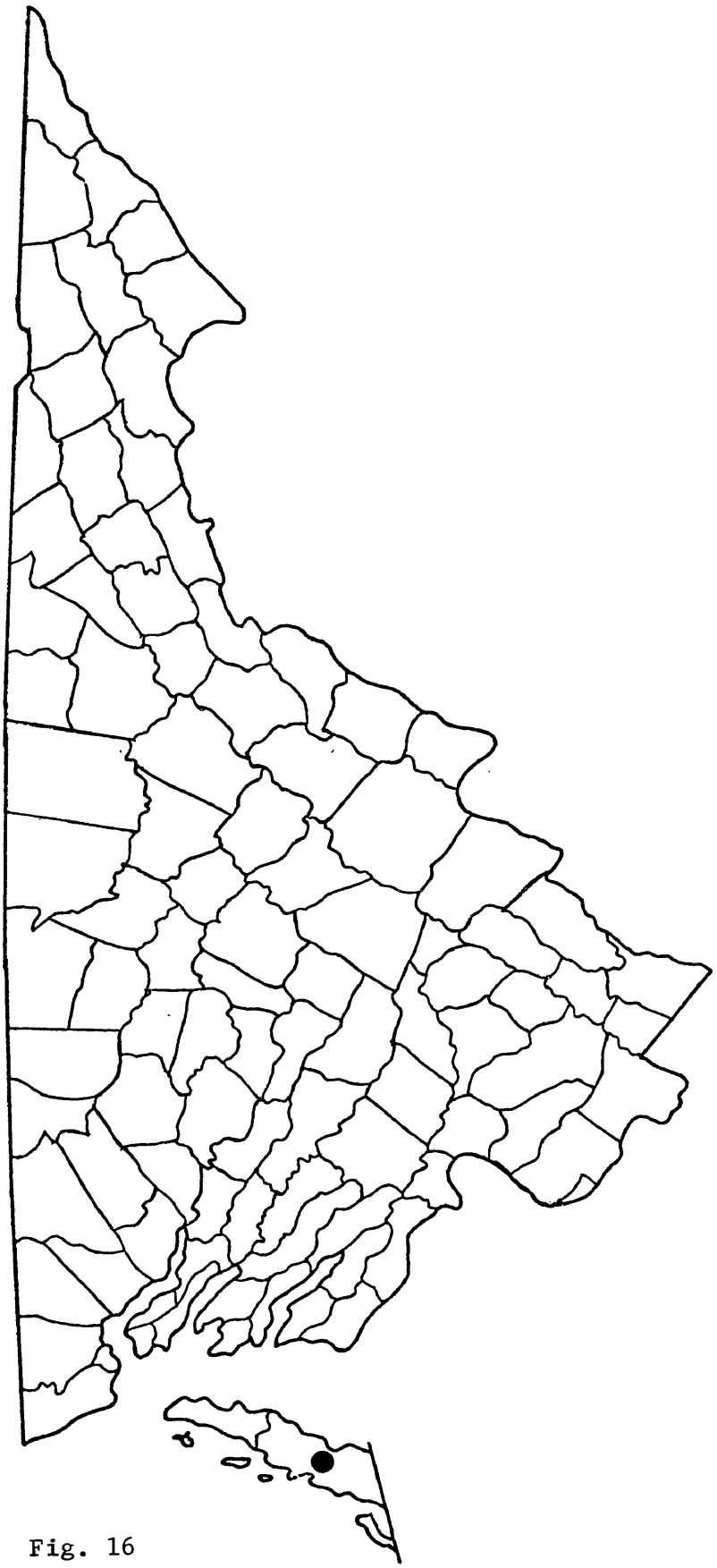


Fig. 16

Inflorescence a corymbiform cyme; pedicels 3-5 mm long, shorter than the calyx tube. Calyx 7-9 mm long. Corolla salverform, only slightly longer than the calyx tube; corolla tube twice the length of the corolla lobes; corolla lobes 4, pink, lanceolate, 3-4 mm long. Anthers oblong, 1 mm or less long, spirally twisted following anthesis. Stigma capitate. Fruit a capsule. Late June-Aug. Wet fields, waste places.

Specimens Examined

ACCOMACK: Harvill 32493 (FARM); Harvill & Wise 33147 (FARM).

GENTIANA L.

Annual or perennial herbs. Stems erect to decumbent, terete or wing-angled. Roots fibrous in annuals; thick and fleshy in perennials. Inflorescence terminal and solitary or cymose. Cauline leaves opposite, sessile to attenuate. Calyx tubular and lobed; calyx lobes 4-5. Corolla tubular; corolla lobes 4-5, often united by appendages. Stamens 4-5; anthers free or connate. Stigma lobes 2, erect, recurved following anthesis; style quite short. Fruit a capsule. Seeds numerous, winged or wingless.

KEY TO GENTIANA

Calyx and corolla 4-merous . . . . . Gentiana crinita

Calyx and corolla 5-merous .

Herbaceous annual; stem wing-angled . . . . . Gentiana quinquefolia

Herbaceous perennial; stem terete.

Corolla greenish white . . . . . Gentiana villosa

Corolla blue to violet.

Calyx lobes linear. . . . . Gentiana decora

Calyx lobes shaped otherwise (lanceolate, oblanceolate, obovate, or orbicular).

Calyx lobes oblanceolate.

Corolla lobes spreading, exceeding the appendages in length by 2-5 mm . . . . . .Gentiana catesbaei

Corolla lobes incurved, exceeding the appendages in length by 2.5 mm or less. . . . .Gentiana saponaria

Calyx lobes lanceolate, obovate or orbicular.

Calyx lobes lanceolate; calyx tube puberulent . . . . . Gentiana austromontana

Calyx lobes obovate or orbicular; calyx tube glabrous. . . . . Gentiana clausa

Gentiana crinita Froel., Gent. Diss. 112. 1796.

Gentiana ciliata L., Syst. 1: 645. 1756.
Gentiana fimbriata Andr., Bot. Rep. 509. 1808.
Denckea crinita (Froel.) Raf., Med. Repos. II. 5: 352. 1808.
Anthopogon incarnatum Raf., New Fl. N. Am. 4: 90. 1836.
Anthopogon brevifolium Raf., New Fl. N. Am. 4: 91. 1836.
Gentiana crinita Froel. forma albina Fern., Rhodora 19: 152. 1917.

Annual herb. Stem simple or branched, 1-6 dm tall. Basal leaves present or absent at anthesis, simple, spatulate, 0.8-1.6 cm long, 1-6 mm wide, apex rounded or obtuse, attenuate. Cauline leaves simple, opposite, ovate, 1.0-8.0 cm long, obtuse, with subcordate bases. Inflorescence of a single terminal flower often accompanied by few to many axillary flowers; pedicels 2-22 cm long. Calyx tube 8-15 mm long, 5-15 mm wide; calyx lobes 4, triangular ovate to lanceolate, 1.0-1.4 cm long, 2-3 mm wide, subulate. Corolla deep blue, 2.5-6.0 cm long; corolla lobes 4, obovate, spreading almost horizontally, 1-3 cm long, 5-8 mm wide, margins fimbriate with fimbriae up to 5 mm long; appendages absent. Anthers 2-5 mm long,

Gentiana crinita Froel.

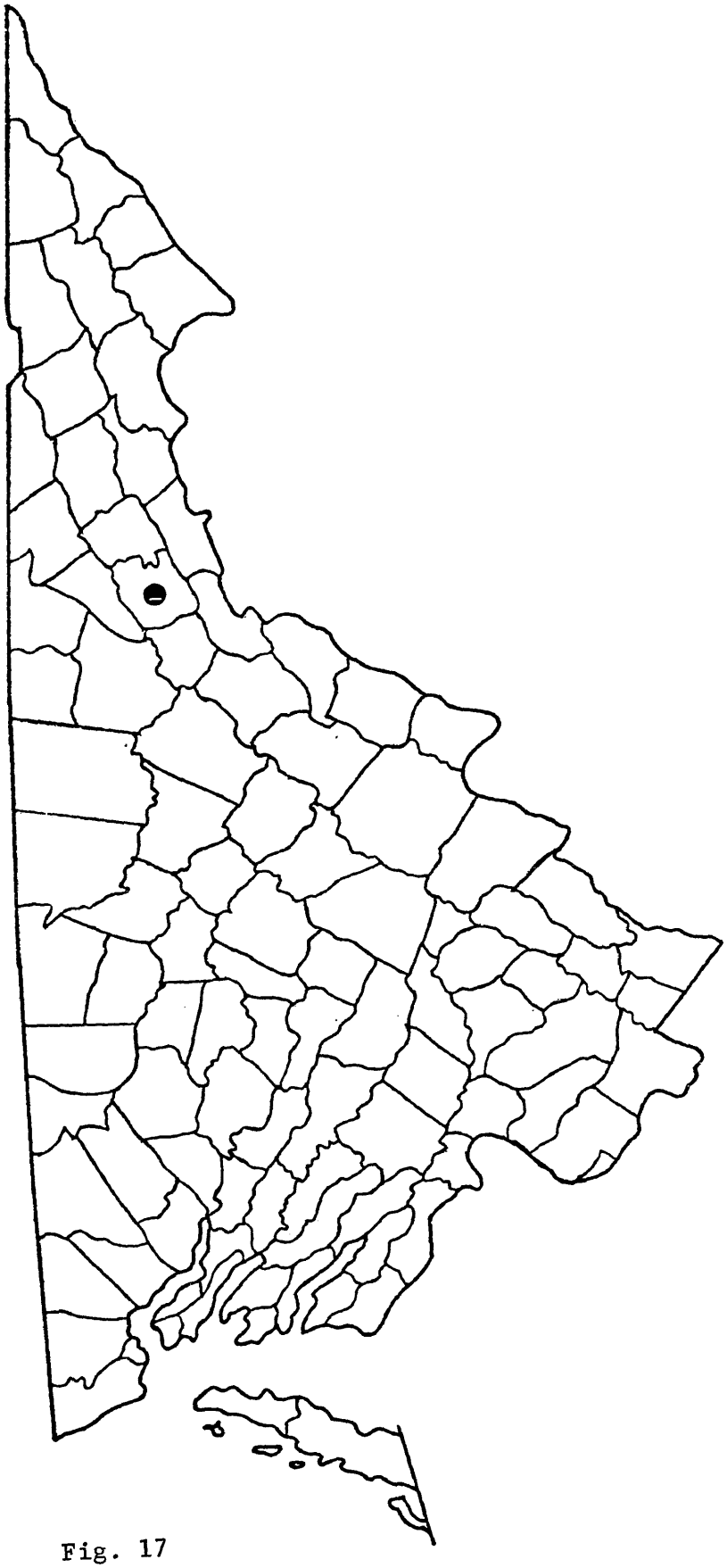


Fig. 17

1-1.5 mm wide; filaments 2-4 cm long, extending most of the length of the corolla tube. Capsule lanceolate, dehiscent in the upper one third. Seeds light brown, oblong, papillose. Late Aug.-Nov. Seepage slopes, damp meadows, wet thickets, brooksides, calcareous habitats.

Specimens Examined

MONTGOMERY: Smyth 2717 (VPI).

Gentiana quinquefolia L., Sp. Pl. 1: 230. 1753.

Gentiana quinqueflora Lam., Encyc. 2. 643. 1768.
Hippion quinquefolium (L.) Schmidt, Roem. Archiv. f. Bot. 1: 11. 1796.
Gentiana amarelloides Michx., Fl. Bor.-Am. 1: 175. 1805.
Aloitis parviflora Raf., Fl. Tellur. 3: 21. 1837.
Aloitis quinqueflora (L. emend. Lam.) Raf., Fl. Tellur. 3: 22. 1837.
Gentiana quinqueflora Lam. var. parviflora Raf. ex Griseb., DC. Prod. 9: 100. 1845.
Gentiana quinquefolia L. var. amarelloides (Michx.) Britt., Mem. Torr. Bot. Club. 5: 260. 1894.
Aloitis divaricata Greene, Leafl. Bot. Obs. & Crit. 1: 94. 1904.
Amarella amarelloides (Michx.) Green, Leafl. Bot. Obs. & Crit. 1: 53. 1904.
Gentianella quinquefolia (L.) Small, Fl. Southeast. U.S. 929. 1903.
Gentiana quinquefolia L. forma lutescens Fern., Rhodora 19: 151. 1917.

Annual herb. Stem wing-angled, usually much branched above, 1.5-6.0 dm tall. Basal leaves may or may not be present. Cauline leaves simple, opposite, sessile, clasping; lower cauline leaves broadly ovate, 0.5-8.0 cm long, 0.5-4.5 cm wide, acute, with cordate bases; upper cauline leaves ovate-lanceolate, much reduced in size. Inflorescence of few to many compact cymes; pedicels 2-17 mm long. Calyx tube 1.5-2.0 mm long; calyx lobes 5, narrowly lanceolate, 2.0-2.5 mm long, 0.5-1.0 mm wide, margins entire. Corolla violet, 1.6-1.8 cm long; corolla lobes 5, ovate, 5-9 mm long, 2-3 mm wide, apiculate; appendages absent. Anthers oblong, 1.5-1.8 mm long, 0.4-0.5 mm wide; filaments 3-5 mm long, 0.7-1.0 mm wide. Stigma

Gentiana quinquefolia L.

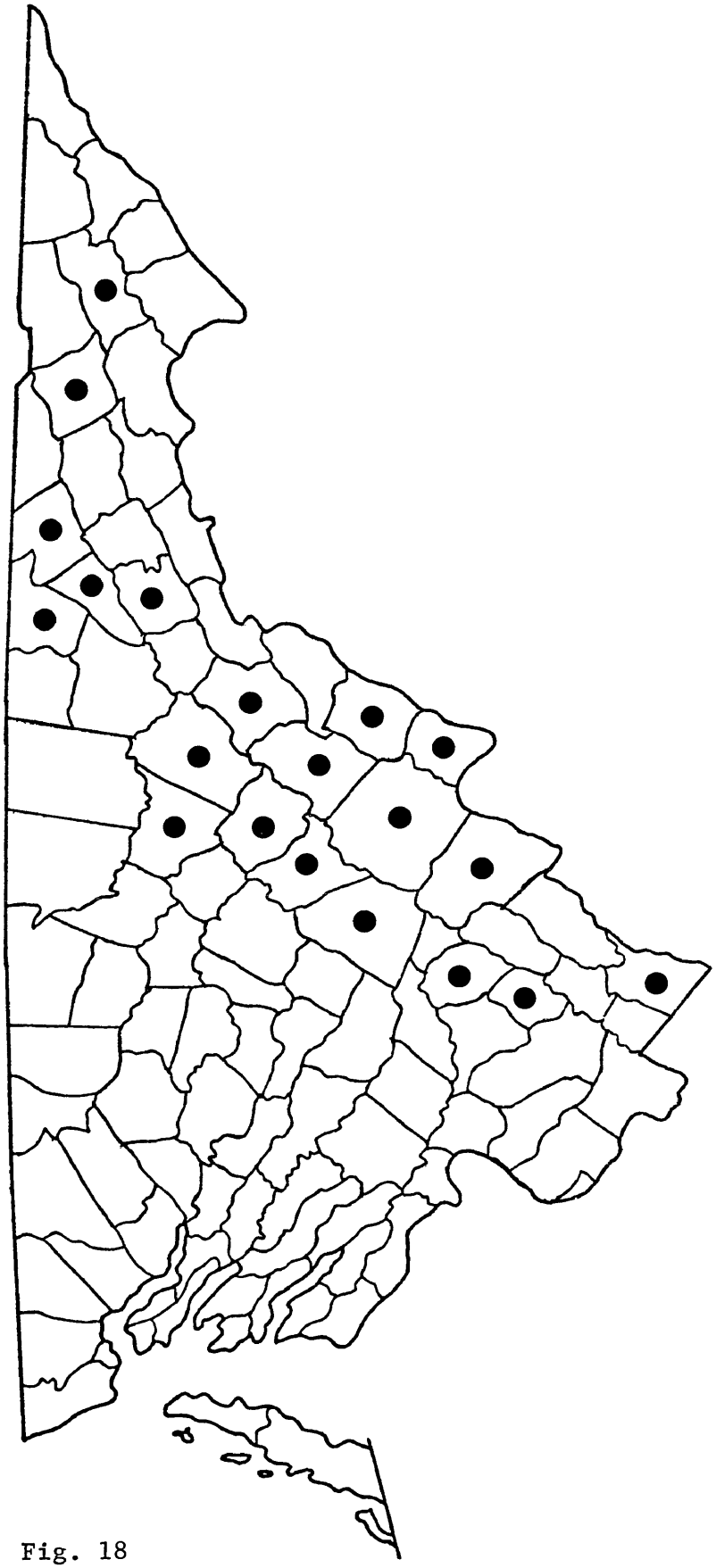


Fig. 18

oblong, 0.9-1.0 mm long, 0.2-0.3 mm wide, recurved. Capsule ellipsoid, 1.5-2.5 cm long, dehiscing apically. Seeds light brown, 0.5-0.6 mm long. Aug.-Oct. Road banks, stream margins, and rich woods.

Specimens Examined

ALBEMARLE: Stevens 1563 (FARM); AMHERST: Stevens & Carr 11589 (FARM); Freer 2871 (LYN, VPI); Freer, Hooks, & Ramsey 3400 (LYN); AUGUSTA: Harvill 20518 (FARM); Massey in 1939 (VPI); (2) Freer 12306 (VPI, LYN); Dickey in 1965 (ODU); BATH: Stevens 1528 (FARM); BEDFORD: Henderson in 1930 (RMWC); Freer 2894 (VPI, LYN, NCU); BOTETOURT: Moore (LYN); Freer 1902 (LYN); Wieboldt & Stevens 2226 (WILLI); Hammond 792 (WILLI); CAMPBELL: Freer in 1936 (VPI); CARROLL: Ogle in 1973 (FARM); CRAIG: Wieboldt & Stevens 2674 (WILLI); FLOYD: Hathaway in 1965 (LYN); FREDERICK: Canby (US); HIGHLAND: Freer 4761 (NCU, VPI, LYN); Freer 4744 (LYN); Culbertson in 1942 (VPI); Stevens 1454 (FARM); MADISON: Roe 1282 (SNP); Weiss 809 (VPI); Weiss in 1957 (VPI); Harley 2673 (FARM); MONTGOMERY: Massey in 1945 (VPI); Massey in 1928 (VPI); Massey in 1936 (VPI); in 1891 (VPI); Stephenson 1 (VPI); Massey 15 (VPI); Massey (VPI); Uttal 6789 (LYN, VPI); Uttal 7721 (VPI); NELSON: Freer 599A (LYN); Harvill 15424 (FARM, NCU); PATRICK: Kral 9674 (NCU, VPI); Kral 11737 (VPI); Lord in 1952 (VPI); in 1940 (VPI); RAPPAHANNOCK: Tidestrom in 1913 (US); ROCKBRIDGE: Freer 17280 (LYN); Freer 599 (LYN); Freer 3374 (LYN, VPI); Crandall in 1966 (RMWC); Uttal 4992 (VPI); ROCKINGHAM: Harvill & Stevens 20076 (FARM); Roe 652 (WILLI); Mosby in 1936 (VPI); RUSSELL: Shields 22726 (NCU); SMYTH: Stevens 2831 (FARM); Massey in 1946 (VPI); Kral 11613 (VPI).

Gentiana villosa L., Sp. Pl. 228. 1753.

Pneumonanthe villosa (L.) Schmidt, Roem, Archiv. für Botanik 1: 10. 1796.

Gentiana ochroleuca Froel., Gent. 35. 1796.
Cuttera ochroleuca (Froel.) Raf., Med. Repos. II. 5: 352. 1808.
Gentiana incarnata Sims, Bot. Mag. 43: 1856. 1816.
Gentiana serpentaria Raf., Ann. Nat. Ann. Synop. 13. 1820.
Gentiana intermedia Sims, Bot. Mag. 49: 2303. 1822.
Ciminalis ochroleuca (Froel.) Bercht. et Presl, Rostl. 1. Gentian 11. 1823.
Gentiana heterophylla Raf., Med. Fl. 1: 211. 1828.
Pneumonanthe ochroleuca (Froel.) G. Don, Gen. Syst. 4: 195. 1837.
Pneumonanthe intermedia (Sims) G. Don, l. c. 1837.
Pneumonanthe incarnata (Sims) G. Don, l. c. 1837.
Gentiana clavata Steud., Nom. ed. 2. 1: 673. 1840.
Gentiana ochroleuca var. incarnata (Sims) Griseb., in DC., Prod. 9: 114. 1845.
Gentiana ochroleuca var. intermedia (Sims) Griseb., l. c. 1845.
Gentiana ochroleuca var. heterophylla (Raf.) Griseb., l. c. 1845.
Dasystephana villosa (L.) Small, Fl. S. E. U. S. 931. 1903.
Dasystephana deloachii Lemmon, Bartonia 19: 18. 1938.
Gentiana deloachii (Lemmon) Shinners, Sida 1: 107. 1962.

Perennial herb. Stems 0.8-6.0 dm tall, glabrous. Roots thick and fleshy. Leaves simple, margins entire, sessile; upper cauline leaves elliptic to obovate, 2.5-10.0 cm long, 1-4 cm wide, acute; lower cauline leaves spatulate, much reduced in size, obtuse; lowest leaves scale-like. Inflorescence a terminal cluster of flowers, sometimes accompanied by axillary flower clusters; flower clusters subtended by 2-3 pairs of involucral bracts; each flower within a cluster also subtended by a pair of bracts. Calyx tube 0.6-1.8 cm long, glabrous; calyx lobes 5, linear, 0.5-3.5 cm long, 0.5-12.0 mm wide, acute, margins entire. Corolla tube greenish white, often suffused with violet, open, 3.0-5.5 cm long; corolla lobes 5, erect, deltoid, 4-10 mm long, 3-6 mm wide, mucronate; unfused portions of the appendages greenish white, obliquely triangular, 1-3 mm long, 2-5 mm wide; sinus between the appendage and the corolla lobe much longer on one side than the other. Anthers connate or separate; filaments separating from the corolla tube 1/4 the distance from the receptacle to the apices of the corolla lobes, 7-10 mm long. Capsule oblong, 1.7-2.5 cm long. Seeds light brown, 1.0-1.3 mm long, wingless. Sept.-Nov.

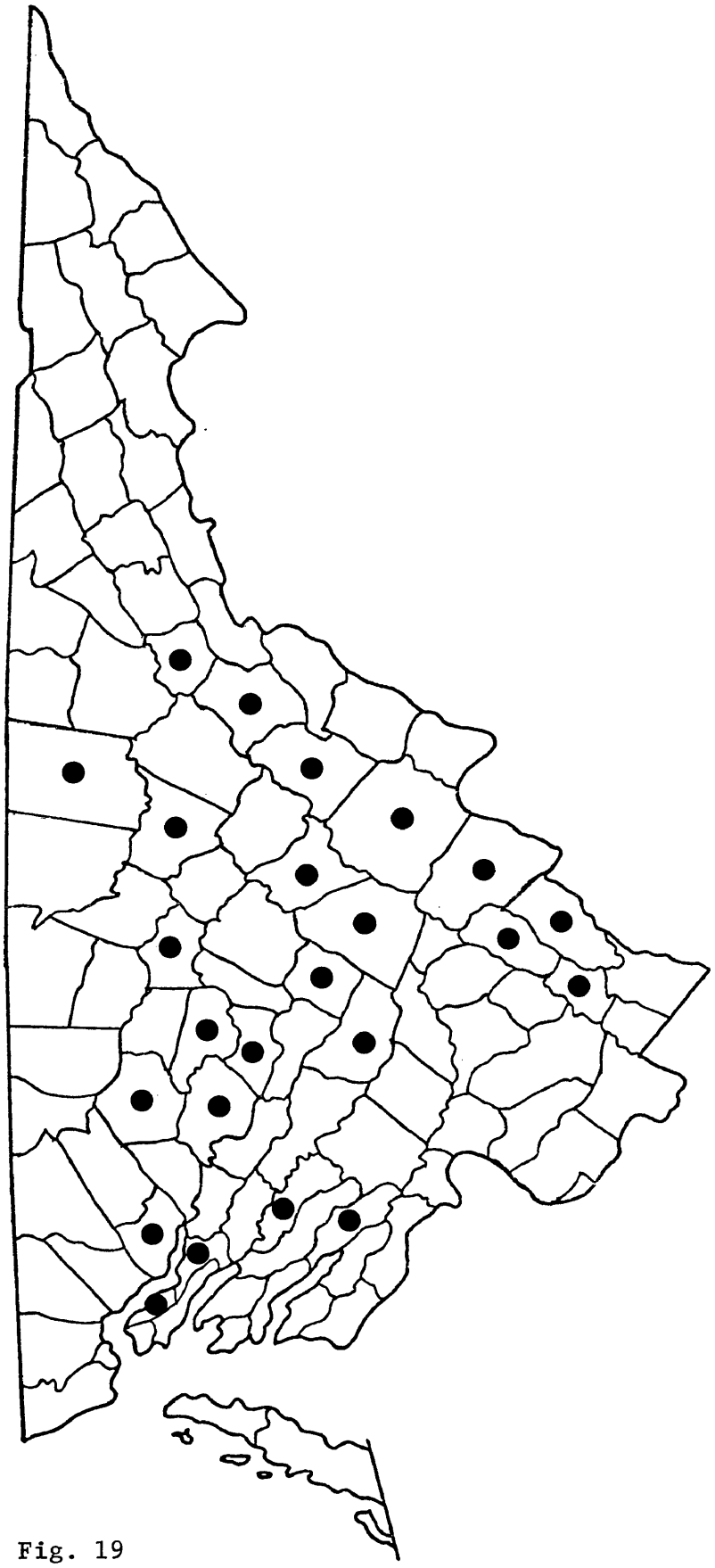


Fig. 19

Mesic woodlands.

Specimens Examined

ALBEMARLE: Steele in 1908 (US); Wieboldt 752 (WILLI); Stevens 1512 (FARM); AMELIA: Lewis 1157 (VPI); Lewis 1332 (VPI); Lewis 1329 (VPI); Lewis 331 (VPI); Lewis 323 (VPI); AUGUSTA: Stevens 412 (LYN); Stevens 482 (FARM); DeGarmis in 1939 (VPI); DeGarmis in 1939 (VPI); BOTETOURT: Moore 2655B (LYN); CAMPBELL: (2) Henderson in 1937 (RMWC); CHESTERFIELD: Parker in 1971 (VCU); DINWIDDIE: Harvill 20995 (FARM); ESSEX: Stevens & Wieboldt 11976 (FARM); FLUVANNA: Diggs, Hall, & Diggs 856 (WILLI); JAMES CITY: Hollis 137 (WILLI); KING WILLIAM: Wieboldt & Stevens 2268 (WILLI); Stevens & Wieboldt 12100 (FARM); LOUISA: Stevens & Harvill 4445 (FARM); NELSON: (2) Uttal 3014 (LYN); NEWPORT NEWS: G.C.M. in 1932 (VPI); Appler & Ware 380 (WILLI); PAGE: Miller in 1905 (US); PITTSYLVANIA: Hathaway in 1963 (LYN); POWHATAN: Corcoran & Diggs 1491 (WILLI); PRINCE EDWARD: Stevens in 1935 (FARM); Ahles & James 62898 (NCU); ROANOKE: Wieboldt & Stevens 2220 (WILLI); Stevens & Wieboldt 11879 (FARM); ROCKBRIDGE: Steele in 1904 (US); ROCKINGHAM: Stevens 1499 (FARM); SHENANDOAH: Steele 102 (US); SURRY: Ware & Ware 6100 (WILLI); Harvill 17977 (FARM); WARREN: Miller in 1897 (US).

Gentiana decora Pollard, Proc. Biol. Soc. Wash. 13: 131. 1900.

Dasystephana decora (Pollard) Small, Fl. S. E. U.S. 930. 1903.
Pneumonanthe decora (Pollard) Greene, Leafl. Bot. Obs. & Crit. 1: 71. 1904.

Perennial herb. Stems erect to decumbent, 1.5-6.0 dm tall, densely puberulent. Roots thick and fleshy. Leaves simple, opposite, lanceolate-elliptic, to ovate-elliptic, 3-10 cm long, 0.8-4.0 cm wide, acuminate, margins ciliate, attenuate; leaves becoming reduced below, lowest leaves

Gentiana decora Pollard

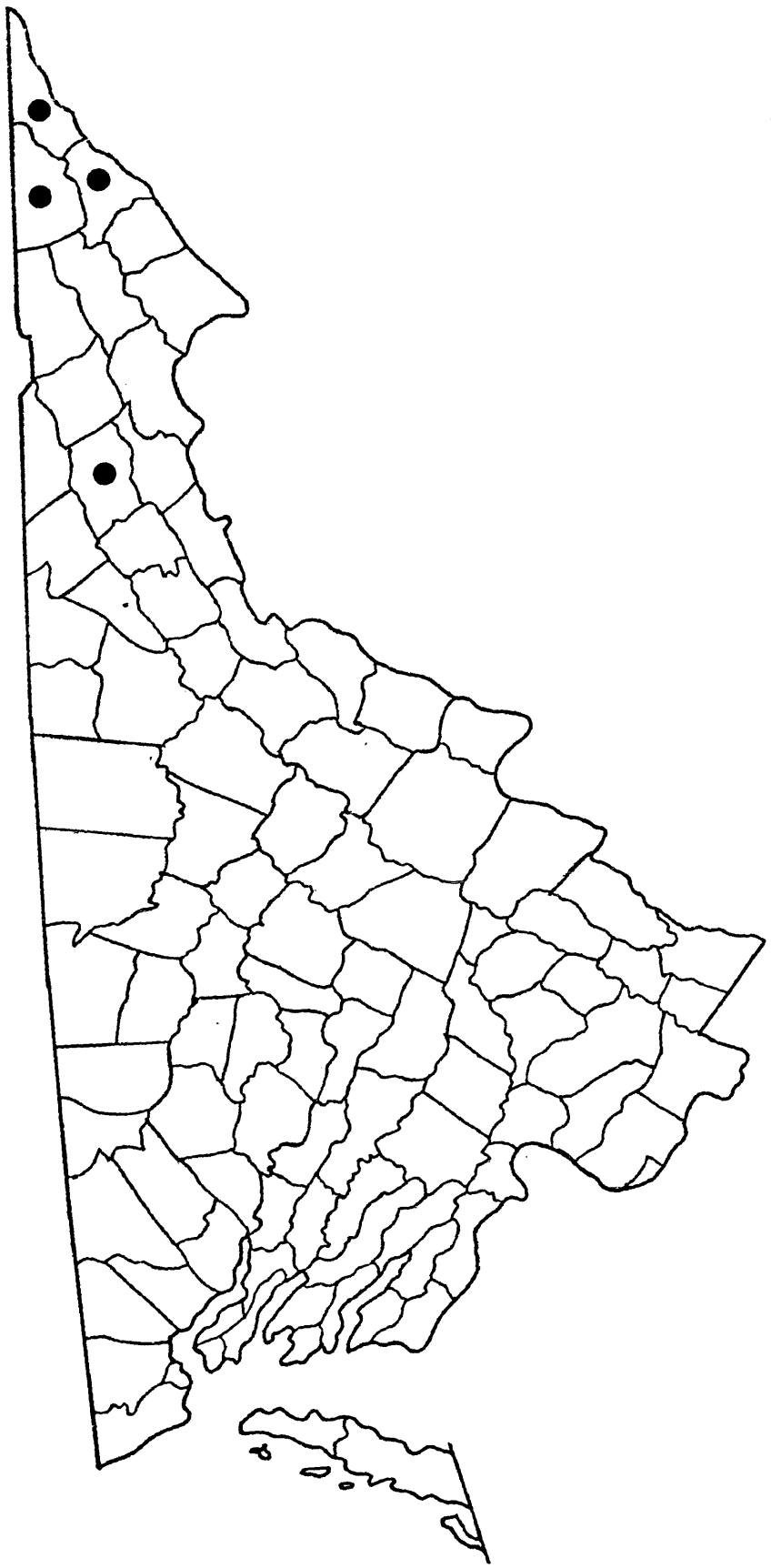


Fig. 20

scale-like. Inflorescence a terminal cluster of flowers, often accompanied by sessile or pedunculate axillary clusters; flower clusters subtended by 1 or 2 pairs of involucral bracts; each flower within a cluster also subtended by a pair of bracts. Calyx tube 0.8-1.2 cm long, densely puberulent; calyx lobes 5, linear to oblanceolate, 2-8 mm long, subulate, margins ciliate. Corolla tube white, suffused with violet, marked by dark violet stripes on the inner surface, somewhat funnelform, open at summit, 2.5-4.5 cm long; corolla lobes 5, erect to spreading, white at base, becoming violet above, broadly ovate, 3-6 mm long, 3.5-6.0 mm wide, mucronate; unfused portions of the appendages divided into 2 unequal segments with denticulate margins, white, 2.0-4.5 mm long, 2-4 mm wide. Anthers connate; filaments separating from the corolla tube about 1/3 the distance from the receptacle to the apices of the corolla lobes, 1.0-1.5 cm long. Seeds brown, 1.3-2.0 mm long, winged. Sept.-early Nov. Mesic woods, stream banks at higher elevations.

Specimens Examined

LEE: Harvill & Stevens 32703 (FARM); SCOTT: Uttal 10263 (VPI); WISE: (2) Culbertson in 1946 (VPI); Culbertson in 1942 (VPI); Harvill 9067A (FARM); WYTHE: Shields 29443 (NCU).

Gentiana catesbaei Walt., Fl. Car. 109. 1788.

Pneumonanthe catesbaei (Walt.) Schmidt, Roem., Archiv für Botanik 1: 10. 1796.
Xolemia trachiloma Raf., Fl. Tellur. 3: 28. 1837.
Gentiana elliottii Chapm., Fl. S. U.S. 556. 1860; non G. elliottea Raf. 1828.
Gentiana elliottii var. parvifolia Chapm., l. c. 1860.
Dasystephana parvifolia (Chapm.) Small, Fl. S.E. U.S. 930. 1903.
Pneumonanthe parvifolia (Chapm.) Greene, Leafl. Bot. Obs. & Crit. 1: 71. 1904.

Gentiana parvifolia (Chapm.) Britt., Man. ed. 2. 733. 1905; non Gilg. 1896.
Gentiana catesbaei var. nummulariaefolia Fern., Rhodora 49: 175. 1947.

Perennial herb. Stems 0.7-7.0 dm tall, puberulent. Roots thick and fleshy. Leaves simple, opposite, lanceolate to ovate or elliptic, 1.5-7.5 cm long, 0.4-3.0 cm wide, acute, margins ciliate, sessile; lower leaves scale-like. Inflorescence a terminal cluster of flowers, often accompanied by pedunculate axillary clusters; flower clusters subtended by 1 or 2 pairs of involucral bracts; each flower within a cluster also subtended by a pair of bracts. Calyx tube 0.7-2.0 cm long, hirtellous on ridges that extend down from the calyx lobes; calyx lobes 5, oblanceolate, 1.0-3.5 cm long, 1.5-10.0 mm wide, margins ciliate. Corolla tube white at base, becoming bluish violet to rose violet above, marked by violet stripes on the inner surface, open at summit, 3.5-6.0 cm long; corolla lobes 5, erect to recurved, violet, broadly ovate, 5-10 mm long, 4.5-8.0 mm wide, mucronate; unfused portions of the appendages divided into 2 subequal segments with dentate margins, violet, 2.0-6.5 mm long, 2-4 mm wide; sinus between corolla lobe and appendage longer on one side than the other. Anthers connate; filaments separating from the corolla tube about 1/3 the distance from the receptacle to the apices of the corolla lobes, 1.2-1.7 cm long. Capsule ellipsoid, 2.5-3.0 cm long. Seeds light brown, 1.8-2.0 mm long, winged. Sept.-Nov. Seasonally moist sites, swampy woodlands, boggy clearings, drainage ditches, peaty swales.

Specimens Examined

ACCOMACK: Bradley 7267 (GMUF); CHARLOTTE: Harvill & Stevens 32920 (FARM); CHESAPEAKE: Harvill 30244 (FARM); CHESTERFIELD: Moriss in 1974 (VCU); GLOUCESTER: Johnson in 1937 (VPI); Greaves 1538 (WILLI); GREENSVILLE:

Gentiana catesbaei Walt.

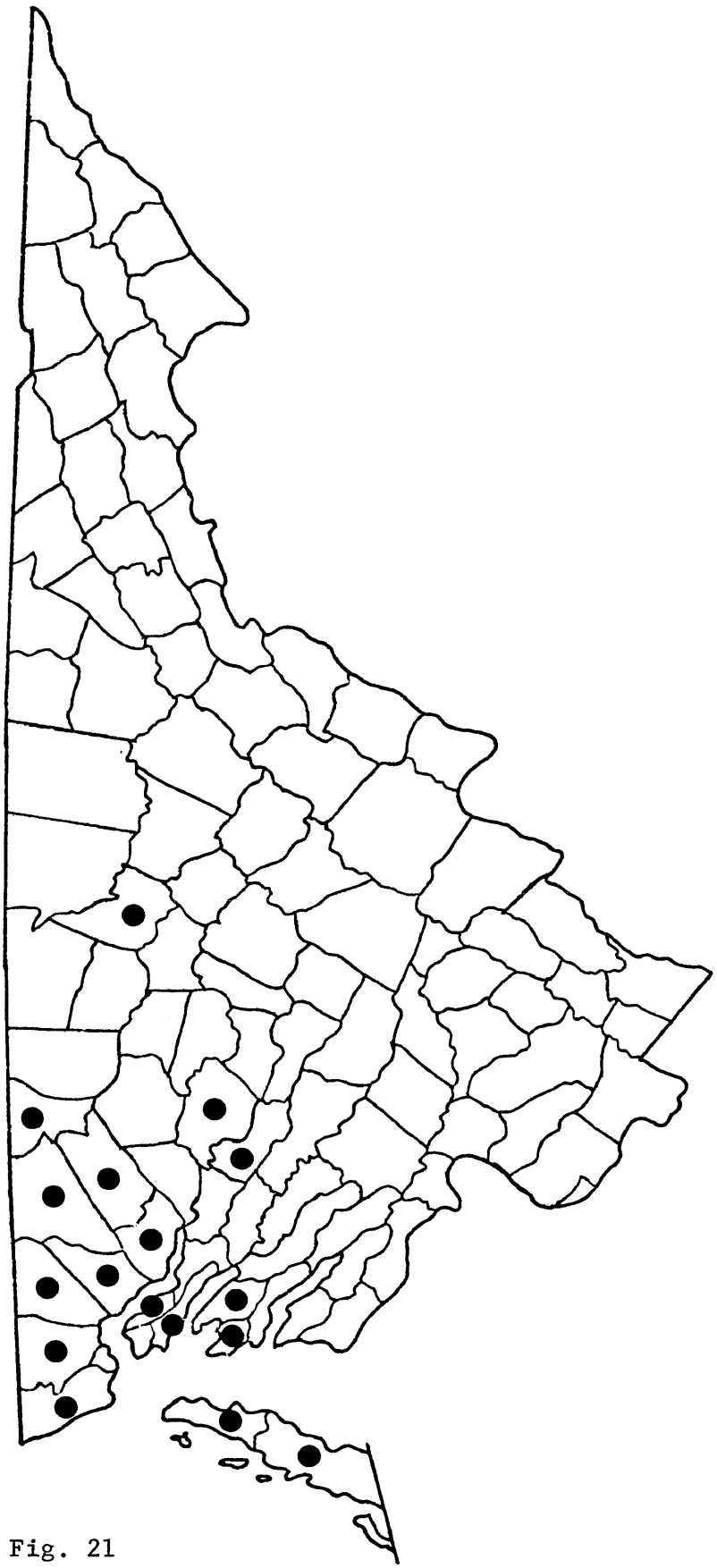


Fig. 21

Harvill 17889 (FARM, NCU); Fernald & Long 9622 (US); HENRICO: Harvill 21077 (NCU); ISLE OF WIGHT: Fernald & Long 6854 (US); Hammond 801, 807 (WILLI); MATHEWS: Johnson in 1937 (VPI); NEWPORT NEWS: Mason in 1938 (VPI); Weiss in 1957 (VPI); NORTHAMPTON: Fernald & Long 5414 (US); SOUTHAMPTON: (2) Massey in 1937 (VPI); Harvill 17910 (FARM); Fernald & Long 9398 (US); Mikula 7967 (WILLI); Johnson & Stepka 3690 (VCU); SUFFOLK: Hathaway in 1967 (LYN); Harvill 22881 (FARM); SURRY: Harvill & Stevens 22998 (FARM); SUSSEX: Harvill 22861 (FARM); Hopkins in 1946 (VPI); YORK: Massey in 1962 (VPI); VIRGINIA BEACH: Fernald & Long 4998 (NCU); Kearney 2137 (US).

Gentiana saponaria L., Sp. Pl. 228. 1753.

Gentiana fimbriata Vahl, Symb. Bot. 3: 46. 1794.
Pneumonanthe saponaria (L.) Schmidt, Roem., Archiv für Botanik 1: 10. 1796.
Gentiana puberula Michx., Fl. Bor.-Am. 1: 76. 1803.
Cuttera saponaria (L.) Raf., Med. Repos. II. 5: 352. 1808.
Ciminalis saponaria (L.) Bercht. & Presl, Rostl. 1. Gentian 11. 1823.
Gentiana elliottea Raf., Med. Fl. 1: 212. 1828.
Gentiana axillaris Raf., Med. Fl. 1: 213. 1828.
Gentiana saponaria var. puberula (Michx.) Torr. & Gray ex A. Gray, Man. 360. 1848.
Gentiana scaberrima Kusn., Acta Horti Petrop. 13: 59. 1893.
Dasystephana puberula (Michx.) Small, Fl. S.E. U.S. 930. 1903.
Dasystephana saponaria (L.) Small, l. c. 1903.
Dasystephana latifolia (Chapm.) Small, l. c. 1903.
Pneumonanthe puberula (Michx.) Greene, Leafl. Bot. Obs. & Crit. 1: 71. 1904.
Pneumonanthe latifolia (Chapm.) Greene, l. c. 1904.
Gentiana latifolia (Chapm.) Britt., Man. ed. 2. 1075. 1905.
Dasystephana cherokeensis Lemmon, Bartonia 17: 4. 1935.
Gentiana cherokeensis (Lemmon) Fern., Rhodora 41: 487. 1939.
Gentiana saponaria var. allegheniensis Jennings, Castanea 12: 57. 1947.

Perennial herb. Stems erect or decumbent, 0.8-7.0 dm tall, typically glabrous, occasionally sparsely puberulent. Roots thick and fleshy. Leaves simple, opposite, variable in shape, sometimes linear, more often elliptic to obovate, 1.5-12.0 cm long, 0.3-3.0 cm wide, obtuse or acute, margins ciliate,

sessile; lower leaves scale-like. Inflorescence a terminal cluster of flowers, often accompanied by pedunculate axillary clusters; flower clusters subtended by 1 pair of involucral bracts; each flower within a cluster also subtended by a pair of bracts. Calyx tube 0.5-1.5 cm long, essentially glabrous; calyx lobes 5, narrowly oblanceolate to oblanceolate, 0.4-1.7 cm long, 0.8-4.0 mm wide, acute, margins ciliate. Corolla tube greenish white at base, becoming blue above, deep blue stripes present on inner surface, slightly open at summit, 3-5 cm long; corolla lobes 5, curved inward, blue, rounded, 2.8-7.0 mm long, 3.5-6.0 mm wide, mucronate; unfused portions of the appendages divided into 2 equal segments with dentate margins, blue, 2.5-6.5 mm long, 2.5-4.0 mm wide. Anthers connate; filaments separating from the corolla tube about 1/4 the distance from the receptacle to the apices of the corolla lobes, 1.0-1.5 cm long. Capsule ellipsoid, 1.9-2.4 cm long. Seeds light brown, 2.0-2.2 mm long, winged. Late Aug.-mid Nov. Bogs, moist or seasonally wet thickets, sphagnous ditches.

Specimens Examined

AMELIA: Lewis in 1936 (VPI); (2) Lewis 338 (VPI); Lewis 1324 (VPI); APPOMATTOX: Stevens 9942 (FARM); BRUNSWICK: Harvill 27352 (FARM); BUCKINGHAM: Stevens 11867 (FARM); CAMPBELL: Ramsey in 1974 (LYN); Freer in 1943 (VPI); CAROLINE: Harvill 22744 (FARM); CHARLES CITY: Ware 3907 (WILLI, NCU); Ware & Pendley 3879 (WILLI, NCU); Hammond & Ware 797 (WILLI); CHARLOTTE: Harvill & Stevens 32941 (FARM); Harvill & Stevens 32920 (FARM); CHESTERFIELD: Johnson 6644 (VCU); Harvill in 1967 (FARM); DINWIDDIE: Harvill 20997 (FARM); Hammond 793 (WILLI); ESSEX: Stanley & Miller 9569 (GMUF); GLOUCESTER: Greaves 1543 (WILLI); GREENSVILLE:

Gentiana saponaria L.

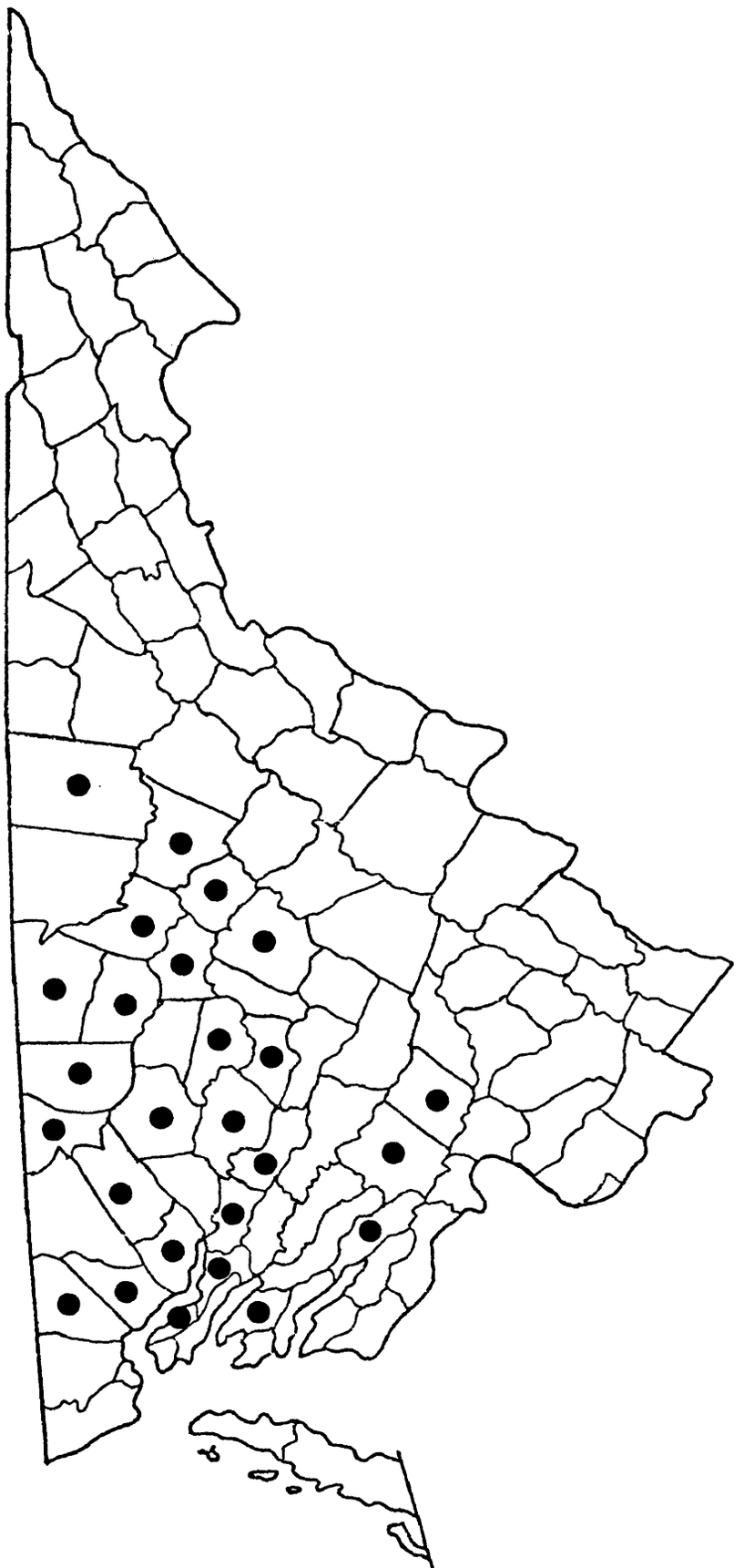


Fig. 22

Harvill 27356 (FARM); Harvill 17889 (FARM); HENRICO: Stevens & Davenport 2896 (FARM, VPI); Hopkins in 1946 (VPI); Harvill 21077 (NCU); JAMES CITY: Mikula 8122 (FARM); ISLE OF WIGHT: Fernald & Long 6854 (US); Hammond 799 (WILLI); LUNENBURG: Harvill 30456 (FARM); MECKLENBURG: Harvill 22851 (FARM, WILLI); NEWPORT NEWS: (2) G.C.M. in 1932 (VPI); PITTSYLVANIA: Hathaway in 1963 (LYN); Hathaway in 1963 (LYN); Hathaway in 1964 (LYN); Hathaway in 1965 (LYN); Hathaway in 1967 (LYN); POWHATAN: Redd in 1960 (VPI); PRINCE EDWARD: Ahles & James in 1965 (NCU); Harvill in 1963 (FARM); Harvill 23053 (WILLI); Harvill 21133 (ODU); SPOTSYLVANIA: Stevens & Harvill 6175 (FARM); Harvill & Stevens 27199 (FARM); SUFFOLK: Harvill 22881 (FARM, NCU); SURRY: Harvill 17984 (NCU, FARM); Hammond 802, 798, 805 (WILLI); SUSSEX: Harvill & Stevens 23322 (FARM); Fernald & Long 9617 (VPI); Massey in 1959 (VPI); Hammond 801 (WILLI); NO COUNTY DATA: G.C.M. in 1932 (VPI).

Gentiana austromontana Pringle & Sharp, Rhodora 66: 402. 1964.

Perennial herb. Stems 0.9-5.0 dm tall, puberulent. Roots thick and fleshy. Leaves simple, opposite, ovate-elliptic to lanceolate, 3-11 cm long, 1-3 cm wide, acuminate, margins ciliate, sessile; lowest leaves scale-like. Inflorescence a terminal cluster of flowers, occasionally accompanied by pedunculate or sessile axillary clusters; flower clusters subtended by 1 or 2 pairs of involucral bracts; each flower within a cluster also subtended by a pair of bracts. Calyx tube 0.7-1.3 cm long, puberulent; calyx lobes 5, ovate to lanceolate, 1.5-12.0 mm long, 1-6 mm wide, accuminate, margins ciliate. Corolla tube white at base, becoming blue-violet above, marked by dark violet stripes on the inner surface, closed, tapering to a narrow summit, 3-5 cm long; corolla lobes 5, violet,

Gentiana austromontana Pringle & Sharp

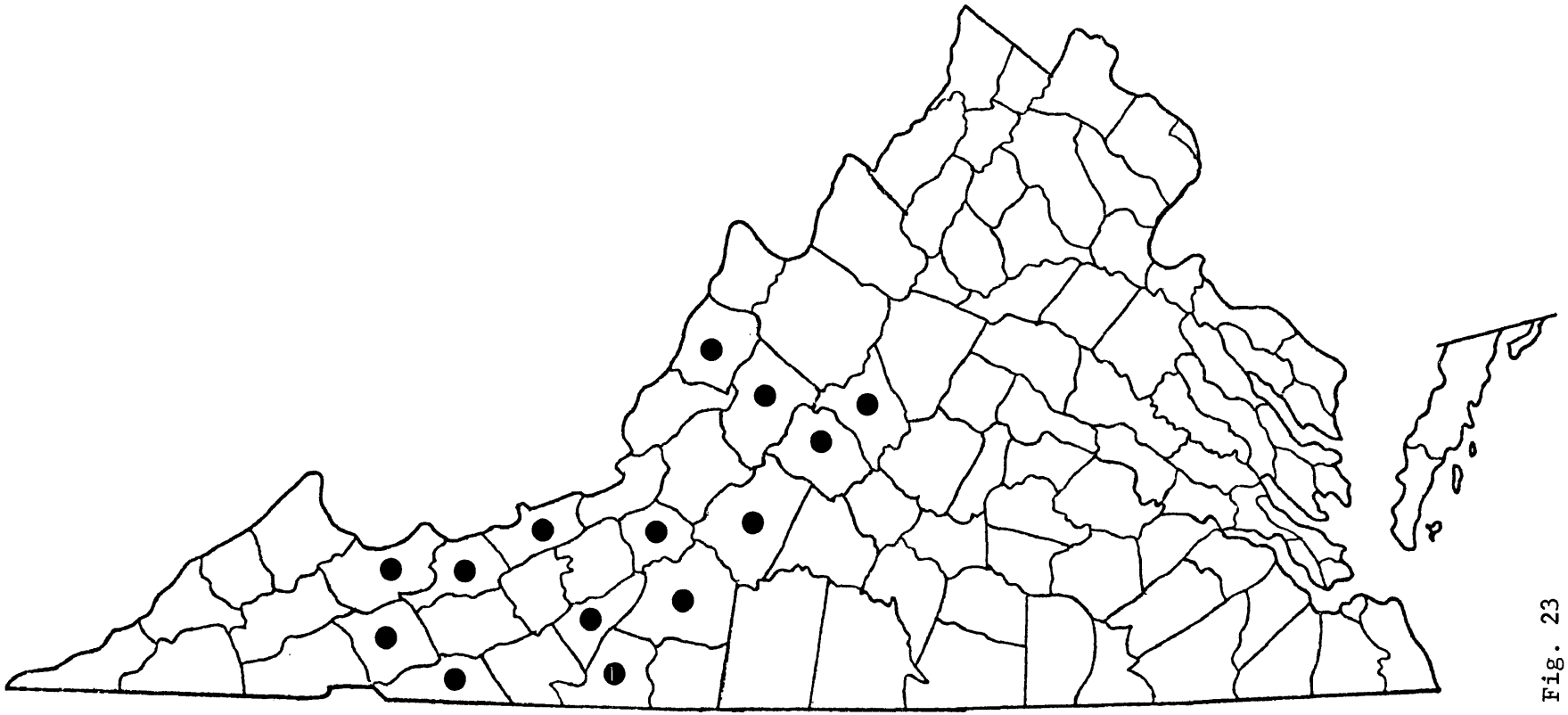


Fig. 23

triangular, 1.5-3.0 mm long, 1.0-3.5 mm wide, mucronate; unfused portions of the appendages divided into 2 equal segments with denticulate margins, white along edges adjacent to corolla lobes, otherwise pale violet, conspicuous at summit of corolla, 2-3 mm long, 3.5-6.0 mm wide. Anthers connate; filaments separating from the corolla approximately 1/2 the distance from the receptacle to the apices of the corolla lobes, 0.7-1.2 cm long. Seeds brown, winged. Early Sept.-mid Oct. Meadows, trailsides, wooded stream banks at high elevations.

Specimens Examined

AMHERST: Freer in 1971 (LYN); BATH: Stevens 1529 (FARM); BEDFORD: Freer in 1964 (VPI); BLAND: Uttal 7707 (VPI); FLOYD: Stevens 8191 (FARM); FRANKLIN: Hathaway in 1967 (LYN); GILES: Massey in 1940 (VPI); Kral 9650 (NCU); Givens in 1937 (VPI); Givens in 1957 (VPI); Thorton in 1938 (VPI); Hathaway in 1967 (LYN); Givens in 1949 (VPI); M.L. in 1938 (VPI); Honick 36 (ODU); Massey in 1939 (VPI); Parker in 1971 (VCU); GRAYSON: Ogle in 1973 (FARM); Roller in 1940 (VPI); NELSON: Freer 600 (LYN); Freer in 1933 (LYN); PATRICK: Kral 9697 (VPI); Hathaway in 1966 (LYN); Pendleton in 1954 (VPI); Kral 9675 (VPI); ROANOKE: Uttal 8454 (NCU); ROCKBRIDGE: Freer in 1971 (LYN); SMYTH: Stevens 2844 (FARM, VPI); (2) Massey in 1946 (VPI); TAZEWELL: Music in 1970 (VPI).

Gentiana clausa Raf., Med. Fl. 1: 210. 1828.

Gentiana andrewsii var. intermedia Kusn., Acta Horti Petrop. 15: 189. 1896.
Pneumonanthe clausa (Raf.) Greene, Leafl. Bot. Obs. & Crit. 1: 71. 1904.
Dasystephana clausa (Raf.) Heller, Cat. ed. 3. 284. 1913.

Perennial herb. Stems 1.7-8.0 dm tall, glabrous. Roots thick and fleshy. Leaves simple, opposite, ovate to ovate-lanceolate, 4.5-15.0 cm long, 1.0-5.5 cm wide, accuminate, margins ciliate, sessile; lower leaves becoming reduced in size, lowest leaves scale-like. Inflorescence a terminal cluster of flowers, occasionally accompanied by sessile axillary clusters; flower clusters subtended by 2 pairs of involucral bracts; each flower within a cluster also subtended by a pair of bracts. Calyx tube 0.6-1.2 cm long; glabrous; calyx lobes 5, obovate to orbicular, 2-10 mm long, 0.8-8.0 mm wide, mucronate, margins ciliate. Corolla tube white at base, becoming blue to blue-violet above, marked by deep blue stripes on the inner surface of the tube, closed, rounded at the summit, 2.5-4.0 cm long; corolla lobes 5, violet blue, triangular, curved inward, 0.8-2.0 mm long, 2.0-4.5 mm wide; unfused portions of the appendages divided into 2 unequal segments with dentate margins, 0.5-1.8 mm long, 1.0-3.7 mm wide. Anthers connate; filaments separating from the corolla tube about 1/3 the distance from the receptacle to the apices of the corolla lobes, 1.0-1.5 cm long. Seeds light brown, 1.1-1.9 mm long, winged. Late Aug.-Oct. Thickets, woods, brooksides, and roadsides.

Specimens Examined

ALBEMARLE: Stevens 753 (FARM); Stevens 460 (FARM); AMHERST: Freer, Hooks, & Ramsey 3411 (VPI); (2) Freer, Hooks, & Ramsey in 1965 (LYN); Freer in 1932 (LYN); AUGUSTA: Harvill 20510 (FARM); BATH: Stevens 1529 (FARM); Uttal in 1963 (VPI); BEDFORD: (3) Henderson in 1932 (RMWC); BOTETOURT: Moore in 1962 (LYN); HIGHLAND: Culbertson in 1942 (VPI); Stevens 1455 (FARM); MADISON: Weiss in 1957 (VPI); Roe 1239 (SNP); MECKLENBURG: Harvill 22811 (FARM); MONTGOMERY: Massey in 1960 (VPI);

Gentiana clausa Raf.

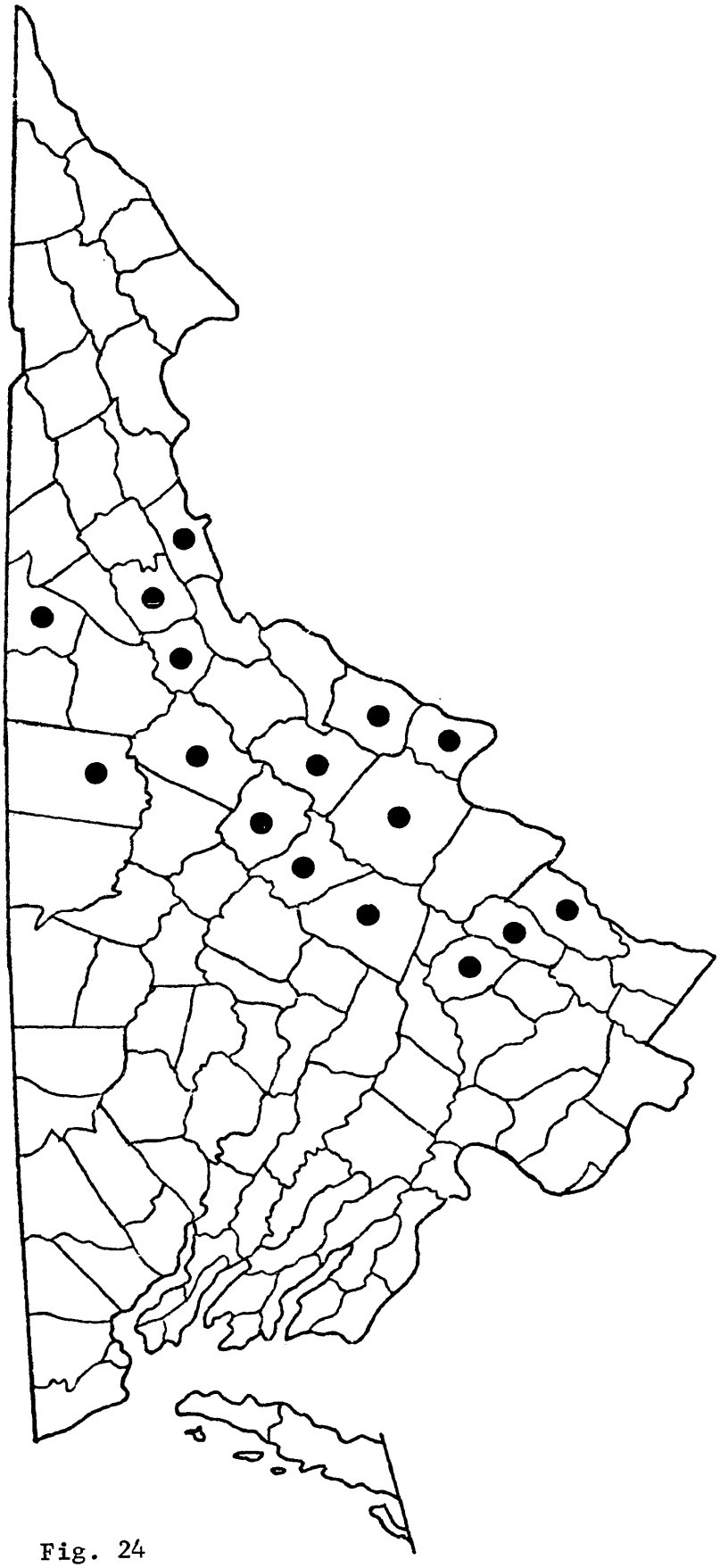


Fig. 24

F. S. H. in 1909 (VPI); PAGE: Harvill 15400 (VPI); NELSON: Freer in 1933 (LYN); Stevens & Davenport 6206 (FARM); ROANOKE: Uttal 6312 (LYN, VPI); ROCKBRIDGE: Steele in 1904 (VPI); SHENANDOAH: Taylor 7 (GMUF).

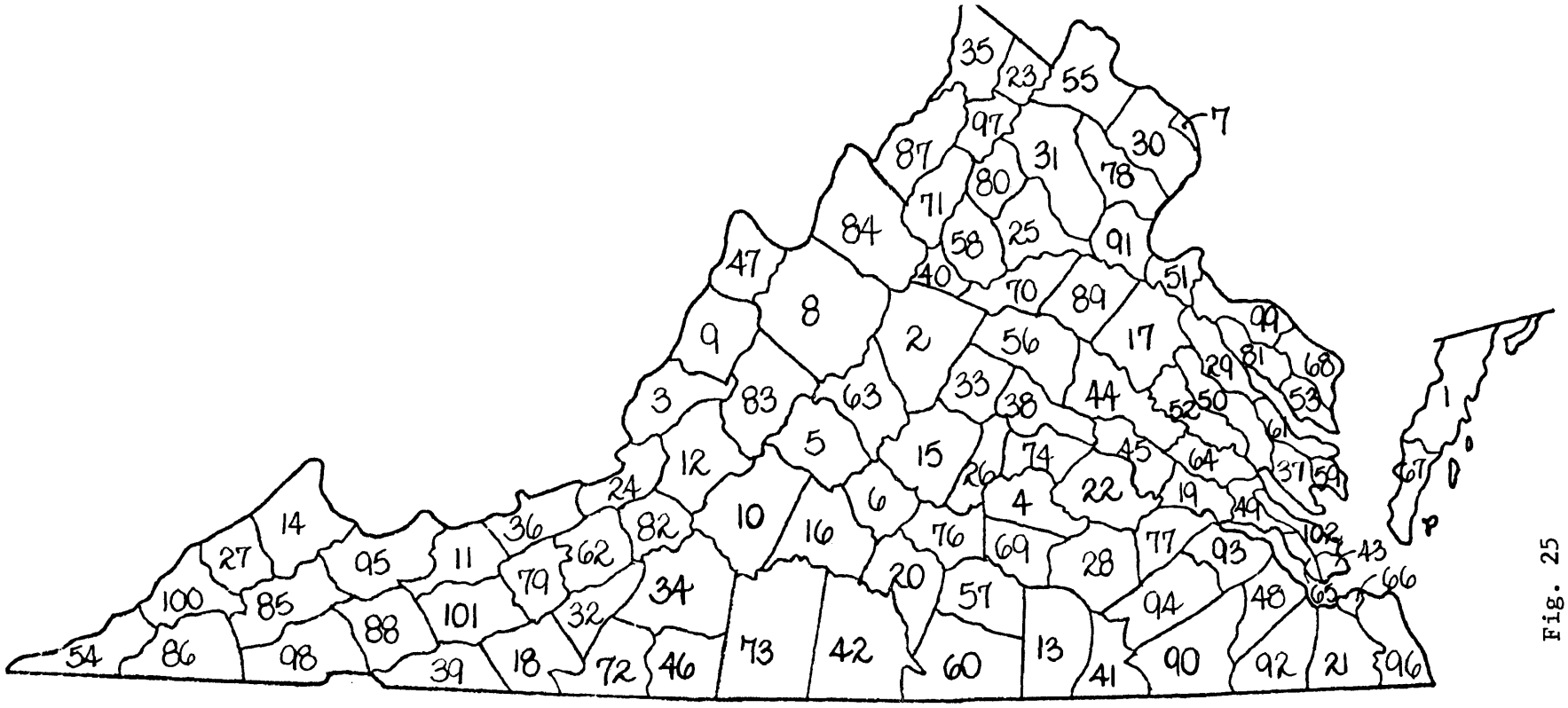


Fig. 25

1 Accomack
2 Albemarle
3 Alleghany
4 Amelia
5 Amherst
6 Appomattox
7 City of Arlington
8 Augusta
9 Bath
10 Bedford
11 Bland
12 Botetourt
13 Brunswick
14 Buchanan
15 Buckingham
16 Campbell
17 Caroline
18 Carroll
19 Charles City
20 Charlotte
21 City of Chesapeake
22 Chesterfield
23 Clarke
24 Craig
25 Culpeper
26 Cumberland
27 Dickenson
28 Dinwiddie
29 Essex
30 Fairfax
31 Fauquier
32 Floyd
33 Fluvanna
34 Franklin
35 Frederick
36 Giles
37 Gloucester
38 Goochland
39 Grayson
40 Greene
41 Greensville
42 Halifax
43 City of Hampton
44 Hanover
45 Henrico
46 Henry
47 Highland
48 Isle of Wight
49 James City
50 King and Queen
51 King George
52 King William
53 Lancaster
54 Lee
55 Loudon
56 Louisa
57 Lunenburg
58 Madison
59 Mathews
60 Mecklenburg
61 Middlesex
62 Montgomery
63 Nelson
64 New Kent
65 City of Newport News
66 City of Norfolk
67 Northampton
68 Northumberland
69 Nottoway
70 Orange
71 Page
72 Patrick
73 Pittsylvania
74 Powhatan
75 City of Portsmouth
76 Prince Edward
77 Prince George
78 Prince William
79 Pulaski
80 Rappahannock
81 Richmond
82 Roanoke
83 Rockbridge
84 Rockingham
85 Russell
86 Scott
87 Shenandoah
88 Smyth
89 Spotsylvania
90 Southampton
91 Stafford
92 City of Suffolk
93 Surry
94 Sussex
95 Tazewell
96 City of Virginia Beach
97 Warren
98 Washington
99 Westmoreland
100 Wise
101 Wythe
102 York

ADDENDUM TO SPECIMENS EXAMINED

Obolaria virginica

CAMPBELL: *Wieboldt & Stevens 2369* (WILLI); FAIRFAX: *Acevedo 46* (WILLI); GLOUCESTER: *Greaves & Gorey 1016* (WILLI); GREENE: *Wieboldt, Mehring, & Howard 1542* (WILLI); NELSON: *Greaves 196C* (WILLI); *Freer in 1940* (LYN).

Bartonia virginica

KING & QUEEN: *Harvill 22786* (WILLI); SUFFOLK: *Kral 12898* (VPI).

Bartonia paniculata

NEW KENT: *Soltis & Hall 691B* (WILLI); NORTHAMPTON: *Ware 6207A* (WILLI).

Sabatia quadrangula

ISLE OF WIGHT: *Hammond 781* (WILLI); NEW KENT: *Gillespie 202* (WILLI); SURRY: *Mikula 3842* (FARM).

Sabatia stellaris

NEW KENT: *Soltis 357* (WILLI); SOUTHAMPTON: *Hathaway in 1967* (LYN).

Sabatia dodecandra

ACCOMACK: *Ware & Wieboldt 6465* (WILLI).

Gentiana villosa

CRAIG: *Wieboldt & Stevens 2673* (WILLI).

Gentiana saponaria

CAMPBELL: *Henderson in 1938* (RMWC); *Freer in 1936* (VPI); CHESTERFIELD: *Morriss 56* (VCU); DINWIDDIE: *Hammond 794, 795, 796* (WILLI);

FRANKLIN: Hathaway in 1967 (LYN); HANOVER: Wieboldt 2687 (WILLI); JAMES CITY: Mikula 8122 (WILLI); POWHATAN: Massey in 1960 (VPI); SOUTHAMPTON: Mikula 7967 (WILLI).

Gentiana austromontana

AMHERST: Stevens & Carr 11569 (FARM); BEDFORD: Freer in 1964 (LYN); GILES: Kral 11767 (VPI); LEE: Stevens & Harvill 32703 (FARM); MONTGOMERY: Stevens 2660 (FARM).

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