

# VIOLETS (VIOLA) OF CENTRAL AND EASTERN UNITED STATES: AN INTRODUCTORY SURVEY

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"VIOLA — Viola, in *Botany*, the common and well known name of a charming flower, most probably originated in its Greek synonym *iov*. At least, the vague and forced etymologies of this word, for which Latin authors have ransacked their own language, prove it not to have come from thence. Nor are the explanations of the Greek much more satisfactory, though the fable of this plant having sprung up on purpose to be the food of the metamorphosed Io, is too poetical to be forgotten. The names of the Violet in modern languages all proceed from the Latin, or from the same source, whatever it may be. The poetry, the romance, the scenery, of every country, is embroidered with the violet, from Caledonia to Arcadia, and the very same individual species is, or has been, the object of homage in both those distant countries. Yet it must be remembered that *iov*, *Viola*, and even the English Violet, are names of more wide-extended and indefinite application, than those of perhaps any other flower, even the Rose not excepted; so as to be nearly synonymous with the word *flower* itself. . . ."

"The arrangement of the species of this ample and interesting genus might, doubtless, be greatly improved, provided any able botanist could compare the leading ones together, in a sufficiently perfect state. . . . In the addition of new species, we have passed over many American ones, mentioned by M. Poiret, because they are probably superceded by the labors of Mr. Pursh. We could not, therefore, undertake, nor did it appear requisite, to settle their synonymy; especially as we have reason to think that the American *Viola* are yet not all well known . . . but we do not scruple to declare that a full scientific botanical essay on *Viola*, might display as much skill and learning, and be made subservient to as much philosophical illustration of botany, as any monographical subject that could be chosen." (J. E. Smith in the *Cyclopaedia* of Abraham Rees, 1817.)

Following is my attempt to improve "the arrangement of the species of this ample and interesting genus" for the central and eastern United States. I have not included other areas, such as the western states, Canada, and Mexico, for I am not yet familiar enough with their violets to make taxonomic judgments.

The present paper is an attempt to render more discernible the morphological and taxonomic differences of the violets. I have made no effort to explain the origin or evolutionary importance of the differ-

ences. These subjects have been and will be discussed in other, more technical papers. Brainerd's splendid monograph of the violets of North America has served us well since 1921, and I hope this small survey will further improve our understanding of the beautiful and popular violets.

The discussions of the species of violets have been arranged in the apparently natural groupings followed by Gershoy (1928). For the most part the groups are quite distinct both morphologically and cytologically and may represent separate evolutionary lines. Keys, distribution maps, and line drawings are offered as aids to the identification of the 47 species and 4 additional varieties or subspecies of violets recognized as occurring naturally in the central and eastern parts of the United States.

For the beautiful line drawings I am indebted to Miss Wilma Monserud of the University of Minnesota and Mrs. Judith Strong (initials JL on the drawings) of Scottsdale, Arizona. I am further indebted to the curators of over 100 American herbaria (too many to list here) for the loan of specimens. Data obtained from these specimens were used in the preparation of the distribution maps. My studies could not have been accomplished without the aid of a series of National Science Foundation grants, which financed them for eight of the fifteen years they have lasted.

My greatest debts are to many students from Grinnell College, Arizona State University, and the Rocky Mountain Biological Station, who have contributed to this paper. Among these the following people were especially helpful: William Bowen, Shirlee Cavaliere, Miwako Cooper-rider, Frank Crosswhite, Jeanette Graham, Millicent Kalil, Stephen Koch, Theodore McConnell, and Arthur Risser. I am also extremely grateful for the varied assistances of dozens of botanists, both professional and non-professional, who have loaned me specimens, given me needed but sometimes ignored or misused advice, taken me to obscure habitats to see obscure violets, and often shared with me their delights in the mysteries of violets and forests.

I dedicate this monograph, with appreciation and respect, to Mrs. Margaret Bergseng, a sympathetic and helpful friend of the violets and of mine for many years, in memory of a field trip after violets that ended in an encounter with a headstone in a cemetery.



## KEY TO CENTRAL AND EASTERN UNITED STATES VIOLETS

(Based principally on the appearance during the spring flowering period)

## 1a. Plants with leafy, aerial stems

## 2a. Plants annual

- 3a. Petals equalled or surpassed by sepals in length . . . . .  
43. *V. arvensis*, p. 102

- 3b. Petals surpassing sepals in length (see also excluded species  
*V. tricolor*, p. 109) . . . . . 44. *V. rafinesquii*, p. 104

## 2b. Plants perennial

- 4a. Petals white or yellow, with purple veins or sometimes purple-tinged

- 5a. Petals white on inner surface, sometimes purple-tinged on outer

- 6a. Stem leaves with blades the same shape as basal leaves, as long as broad; sepals toothed; petals white on both surfaces  
5. *V. striata*, p. 16

- 6b. Stem leaves with blades narrower than basal leaves, longer than broad; sepals entire; petals often purple-tinged on outer surface

- 7a. Basal leaf blades as long as broad; rootstock short and thick, not stolon-like . . . . .  
41a. *V. canadensis* var. *canadensis*, p. 96

- 7b. Basal leaf blades wider than long, broadly reniform; rootstock long and stolon-like . . . . .  
41b. *canadensis* var. *rugulosa*, p. 98

## 5b. Petals yellow, sometimes purple-tinged

- 8a. Leaf blades narrow, 1.5 to 3 times as long as broad; first peduncle produced at base of aerial stems; western . . . . .  
32. *V. nuttallii*, p. 74

- 8b. Leaf blades broader than long; first peduncles produced near apex of aerial stems; central and eastern

- 9a. Leaf blades divided . . . . . 34. *V. tripartita*, p. 80

## 9b. Leaf blades not divided

- 10a. Leaf blades halberd-shaped (triangular), often tinged with purple . . . . . 31. *V. hastata*, p. 72

- 10b. Leaf blades cordate, rarely or never tinged with purple

- 11a. Plants moderately or heavily pubescent, bearing 1 or 2 flowering stems and none or 1 or 2 root leaves

- 12a. Stem with no stipules below first leaf; upper stipules small, inconspicuous; southeastern . . . . .  
34. *V. tripartita*, p. 80

- 12b. Stem with stipules near base; upper stipules large, conspicuous . . . 33a. *V. pubescens* var. *pubescens*, p. 76

- 11b. Plants slightly pubescent, bearing 3 or more flowering stems and 3 or more root leaves . . . . . 33b. *V. pubescens* var. *eriocarpa*, p. 78
- 4b. Petals blue or purple
  - 13a. Spur long (7—12 mm.), narrow and curved . . . . . 4. *V. rostrata*, p. 14
  - 13b. Spur shorter, thicker
    - 14a. Plants prostrate, rooting at the nodes; leaves often suffused with purple; southeastern . . . . . 6. *V. walteri*, p. 18
    - 14b. Plants erect; leaves green
      - 15a. Leaf blades cordate, up to 5 cm. wide; petals light blue . . . . . 2. *V. conspersa*, p. 10
      - 15b. Leaf blades triangular, with truncate or subtruncate bases, rarely more than 2 cm. wide; petals light or dark blue
        - 16a. Plant with thick stems, short and much branched; sepals rather broad, toothed . . . . . 1. *V. adunca*, p. 8
        - 16b. Plant with slender stems, sparingly branched; sepals linear, almost entire . . . . . 3. *V. labradorica*, p. 12
- 1b. Plants without leafy, aerial stems
  - 17a. Petals yellow . . . . . 42. *V. rotundifolia*, p. 100
  - 17b. Petals blue, purple or white
    - 18a. Rootstocks (rhizomes) slender, fibrous; plants often with stolons
    - 19a. Petals blue or purple
      - 20a. Spur 1—2 mm. long; leaves oval, with inconspicuous rounded teeth . . . . . 45. *V. palustris*, p. 106
      - 20b. Spur 5—7 mm. long; leaves cordate, with conspicuous rounded teeth . . . . . 46. *V. selkirkii*, p. 106
    - 19b. Petals white with purple veins
      - 21a. All petals glabrous; plant lacking leafy stolons; leaves reniform . . . . . 40. *V. renifolia*, p. 94
      - 21b. Basal or lateral petals pubescent; plant with vigorous leafy stolons; leaf blades variously shaped
        - 22a. Leaf blades 1.5 or more times as long as broad, their bases cuneate
          - 23a. Leaf blades ovate, 1.5 to 2 times as long as broad . . . . . 39. *V. primulifolia*, p. 92
          - 23b. Leaf blades lanceolate to linear, 3.5 to 15 times as long as broad
            - 24a. Leaf blades lanceolate, 3.5 to 5 times as long as broad
              - 37a. *V. lanceolata* ssp. *lanceolata*, p. 86
              - 24b. Leaf blades linear, 6 to 15 times as long as broad . . . . . 37b. *V. lanceolata* ssp. *vittata*, p. 88
        - 22b. Leaf blades as long as broad or shorter, their bases cordate
          - 25a. Lower pair of petals glabrous; leaf blades about as broad as long . . . . . 35. *V. blanda*, p. 82



- 25b. Lower pair of petals bearded; leaf blades broader than long
  - 26a. Leaf blades pubescent; lateral petals with a heavy tuft of hairs . . . . . 36. *V. incognita*, p. 84
  - 26b. Leaf blades glabrous; lateral petals with a slight tuft of hairs . . . 38. *V. macloskeyi* ssp. *pallens*, p. 90
- 18b. Rootstocks (rhizomes) thick and fleshy; plants not stoloniferous (except the introduced *V. odorata*)
  - 27a. Stolons well developed; flowers sweet-scented . . . . . 47. *V. odorata*, p. 108
  - 27b. Stolons absent; flowers not sweet-scented
    - 28a. Rootstock vertical, short; petals all colored alike, or upper two dark violet, lower three light purple . . . . . 21. *V. pedata*, p. 48
    - 28b. Rootstock horizontal, often elongate; petals all colored alike
      - 29a. Leaves lobed or divided
        - 30a. Leaves lobed or deeply toothed at base only, 1.5 to 3 times as long as broad
          - 31a. Leaves densely pubescent petioles about half as long as the blades . . . . . 12. *V. fimbriatula*, p. 30
          - 31b. Leaves moderately pubescent; petioles as long as the blades or longer . . . . . 24. *V. sagittata*, p. 54
        - 30b. Leaf blades deeply lobed, as wide as long or wider
          - 32a. Leaves moderately to densely pubescent
            - 33a. Leaf blades with 5—9 or more long, linear lobes
              - 34a. Leaves moderately pubescent with long hairs; eastern . . . . . 20. *V. palmata*, p. 46
              - 34b. Leaves finely pubescent with short hairs; mid-western . . . . . 22. *V. pedatifida*, p. 50
            - 33b. Leaf blades with 3—5 broad lobes
              - 35a. Central lobe elongate; south-central . . . . . 16. *V. lovelliana*, p. 38
              - 35b. Central lobe not elongate; central and eastern
                - 36a. Leaf blades with 3 broad, shallow basal lobes
                  - 28a. *V. triloba* var. *triloba*, p. 64
                - 36b. Leaf blades with 5 narrow lobes cut almost to midrib . . . . 28b. *V. triloba* var. *dilatata*, p. 66
    - 32b. Leaves glabrous or very finely pubescent
      - 37a. Leaf blades pedately cut, with narrow lobes
        - 38a. Leaf blades with 9—11 linear lobes . . . . . 8. *V. brittoniana*, p. 22
        - 38b. Leaf blades with 5—7 narrowly oblanceolate lobes

- 39a. Leaf blades with 7 coarsely toothed lobes, the central lobe divided; central Tennessee . . .  
10. *V. egglestonii*, p. 26
- 39b. Leaf blades with 5—7 moderately or shallowly toothed lobes, the central one undivided; southeastern . . . . . 25. *V. septemloba*, p. 56
- 37b. Leaf blades palmately cut, with broad lobes
  - 40a. Leaf blades with 3—5 broad, obovate lobes, the earliest leaves uncut; southeastern . . . . .  
11. *V. esculenta*, p. 28
  - 40b. Leaf blades with 5 or more lanceolate or linear lobes; all leaves cut; midwestern . . . . .  
29. *V. viarum*, p. 68
- 29b. Leaf blades not lobed or divided
  - 41a. Leaf blades moderately to densely pubescent on one or both surfaces
    - 42a. Leaf blades 1 to 1.5 times as long as broad; northern  
19. *V. novae-angliae*, p. 44
    - 42b. Leaf blades as broad as long or broader
      - 43a. Leaf blades equally pubescent on both surfaces
        - 44a. Leaf blades large, broader than long; peduncles as long as the petioles or shorter . . . . .  
27. *V. sororia*, p. 60
        - 44b. Leaf blades small, as long as broad; peduncles up to twice as long as the petioles; southeastern .  
30. *V. villosa*, p. 70
      - 43b. Leaf blades more heavily pubescent on one surface
        - 45a. Leaf blades heavily pubescent with long stiff hairs on upper surface, sparsely pubescent or glabrous on lower, often suffused with purple . . .  
14. *V. hirsutula*, p. 34
        - 45b. Leaf blades heavily pubescent on lower surface, sparsely pubescent on upper, green . . . . .  
26. *V. septentrionalis*, p. 58
    - 41a. Leaf blades glabrous or finely pubescent on upper surface
      - 46a. Leaf blades entirely glabrous
        - 47a. Leaf blades uniformly toothed to the acute apex; midwest prairies . . . . . 23. *V. praticola*, p. 52
        - 47b. Leaf blades with somewhat attenuate apex bearing fewer, more widely-spaced teeth than rest of margin
        - 48a. Upper third of leaf with 10—14 teeth, narrowly triangular; peduncles exceeding the petioles



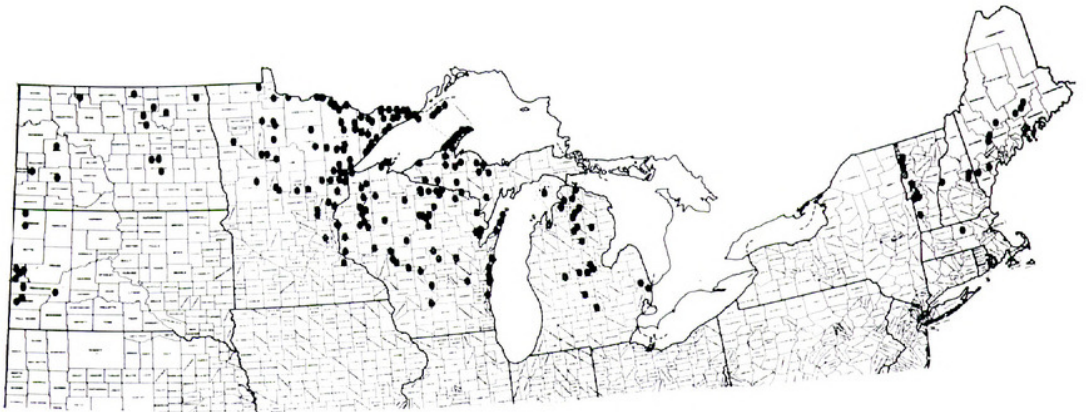
- 49a. Leaf blades cordate; peduncles about 1.5 times  
as long as petioles; southeastern . . . . .  
13. *V. floridana*, p. 32
- 49b. Leaf blades triangular; peduncles about 2 times  
as long as petioles; southern to midwestern . . .  
15. *V. langloisii*, p. 36
- 48b. Upper third of leaf blade with 0—6 teeth, broadly  
triangular; peduncles not exceeding the petioles .  
17. *V. missouriensis*, p. 40
- 46a. Leaf blades pubescent with short, stiff hairs on upper  
surface of basal lobes
- 50a. Hairs rather large, visible without magnification;  
peduncles about equalling petioles; eastern and south-  
eastern woodlands . . . . . 7. *V. affinis*, p. 20
- 50b. Hairs tiny and inconspicuous without magnifica-  
tion; peduncles exceeding petioles; northern bogs, wet  
meadows, and shores
- 51a. Earliest leaves with cordate blades; spur petal  
glabrous, laterals with clavate hairs . . . . .  
9. *V. cucullata*, p. 24
- 51b. Earliest leaves with reinform blades; spur petal  
pubescent, laterals with cylindrical hairs . . . . .  
18. *V. nephrophylla*, p. 42

## GROUP I. STEMMED BLUE VIOLETS.

1. *Viola adunca* J. E. Smith in Rees, Cyclopaedia 37: Viola no. 63. 1817.

This widely distributed and highly variable northern species has had and continues to have a tortuous nomenclatural history. Brainerd reviewed its early history in his monograph (1921). Since that time a number of other names have been applied to morphological variants in the Rocky Mountains. These will not be dealt with here. In the eastern United States this is usually a small plant with dark blue corollas having long, straight or curved basal spur. The best distinguishing character is the shape of the leaf blade, which is broadly triangular with a truncate or only slightly cordate base.

*Viola adunca* hybridizes occasionally with *V. conspersa* when they occur in close proximity (Brainerd, 1924; Fernald, 1950). Normally, however, they occur in non-contiguous habitats, and hybridization is prevented by distance. *V. adunca* usually occurs in open, dry habitats such as clefts of boulders, dry, sandy areas near streams or lakes, and open, dry aspen forests on rocky slopes.

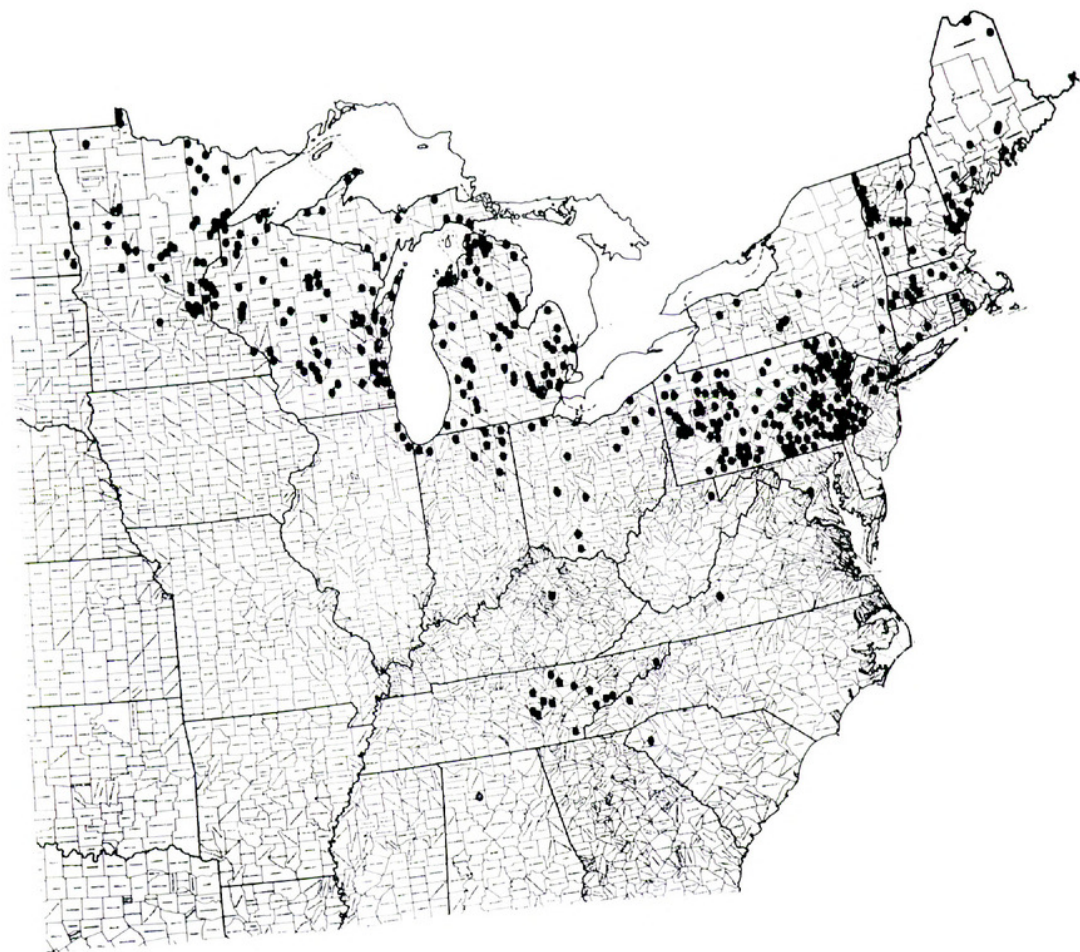






2. ***Viola conspersa*** Reichenb., *Plantae Criticae* 1: 44, pl. 52, Fig. 108. 1823.

The "dog violet" is one of the commonest species of central and north-eastern United States, occurring in a variety of habitats, principally in disturbed stream forests on sandy soil. Here it may occasionally form dense mats. It may grow with *V. affinis*, *V. sororia*, and *V. striata*, a stemmed species it somewhat resembles. Where it comes into contact with *V. walteri* (southern Ohio and eastern Tennessee) and with *V. rostrata* (especially in New England), it grades into them. The intergrading specimens may be considered hybrids when between *V. conspersa* and *V. rostrata*, as these two species are sympatric but morphologically distinct through most of their ranges. It might be better to consider *V. conspersa* and *V. walteri* as regional subspecies of a single species, as they do not remain distinct when sympatric. Another "species" which might be best considered as subspecific with *V. conspersa*, is *V. labradorica*, which replaces it to the north.







3. ***Viola labradorica*** Schrank, Denkschr. Bot. Ges. Regensb. 2: 12. 1818.

I know of but three locations for this violet in the United States: a bog near the shore of Lake Superior at Grand Marais, Cook County, Minnesota, the Susie Islands offshore from Grand Marais, and the White Mountains (Mt. Washington) of New Hampshire. In Canada it occurs from Newfoundland to Alaska, and it is also found in Greenland. Fernald's (1950) report of it in other states (under the name of *V. adunca* var. *minor*) is in error.

I do not agree with Fernald's disposal of this species. It is considerably more similar to *V. conspersa* than to *V. adunca*, and I believe it to represent a northern replacement of *V. conspersa*. *Viola labradorica* differs from *V. conspersa* mainly in its diminutive size, and its tiny, entire stipules.

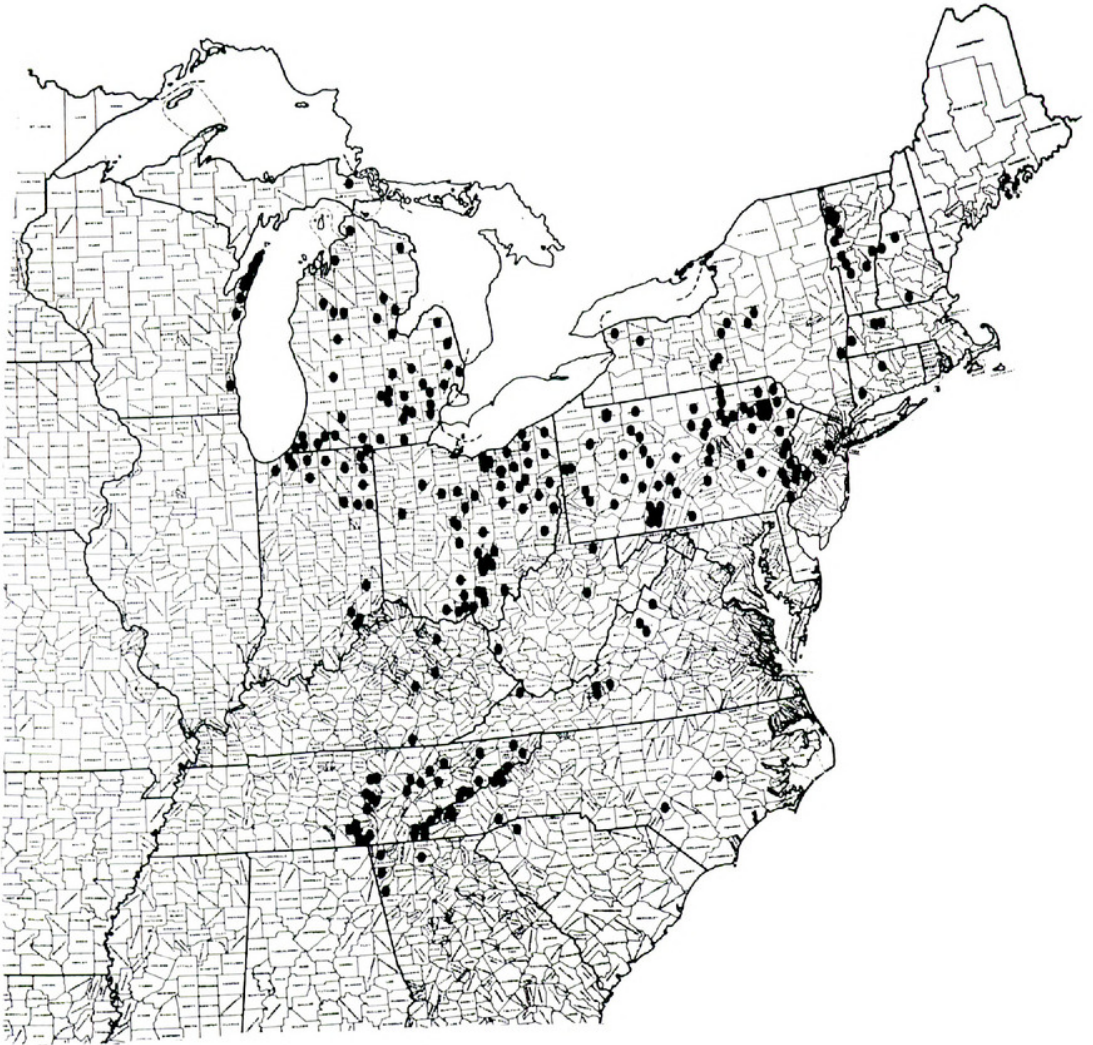




4. ***Viola rostrata*** Pursh, Fl. Am. Sept. 1: 174. 1813 ("1814").

The "long-spurred violet" truly deserves the name. The spur of the basal petal may be up to two centimeters long; it is straight or slightly curved upward. *Viola rostrata* is a member of a complex of similar species which includes *V. conspersa*, *V. adunca*, *V. walteri*, *V. labradorica*, and *V. howellii*. It is sympatric with *V. conspersa* and sometimes hybridizes with it. In addition Brainerd reports a case of hybridization with *V. striata* in Ohio. I have seen *V. rostrata*-*V. striata* hybrids from Pennsylvania and southern Ontario. Dr. Lulu Gaiser has sent me a number of fine hybrid specimens collected near Guelph, Ontario.

In summer, *V. rostrata* may be difficult to distinguish from large plants of *V. conspersa*. It differs in having leaves with more elongated apices; the summer leaves of *V. conspersa* tend to be more oval.



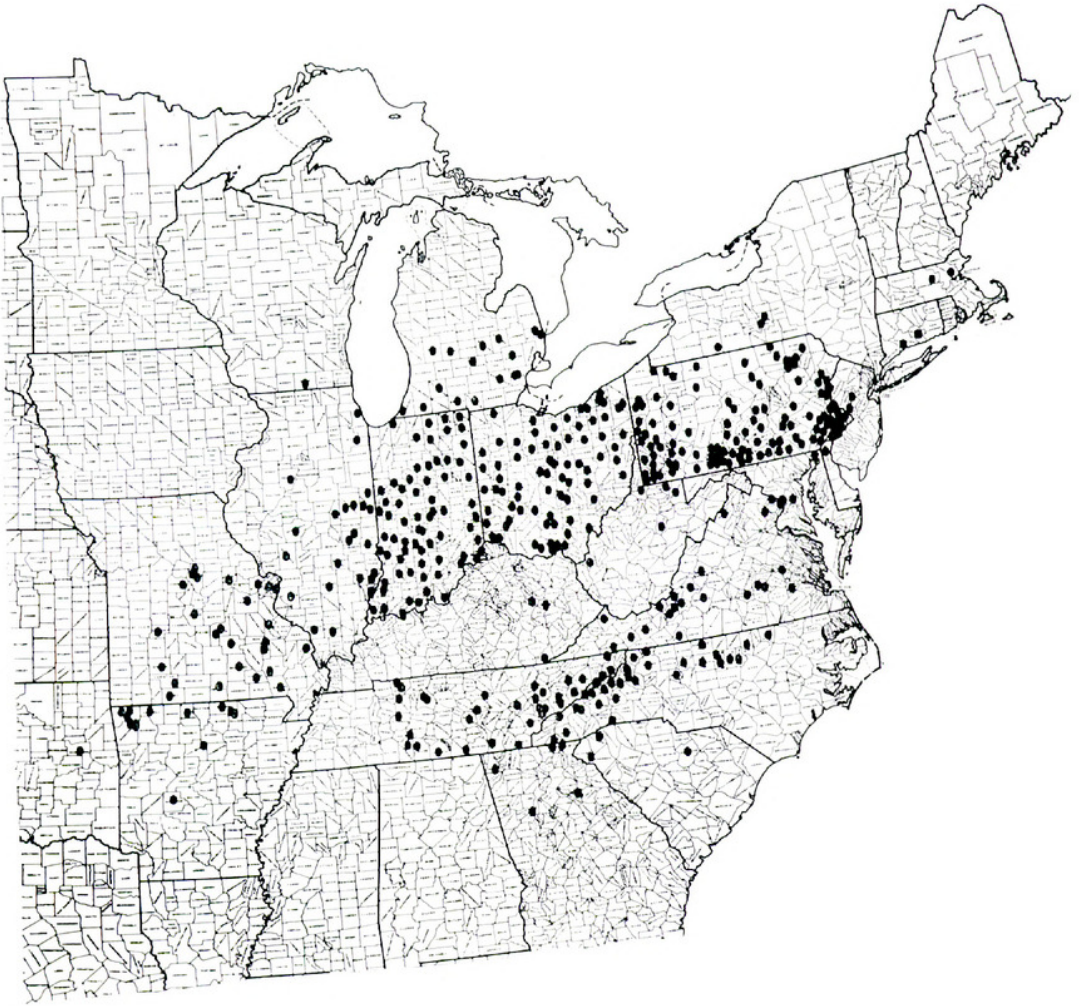




5. ***Viola striata*** Ait., Hort. Kew. 3: 290. 1789.

Ordinarily this stemmed, white-flowered violet is easy to distinguish. It has large, fimbriate sepals. The leaves are remarkably uniform in size and shape along the stem and have small, basal lobes, acute apices, and many small teeth. The petals are creamy white. Occasionally it may hybridize with *V. rostrata*, producing intermediate forms, discussed under that species.

*Viola striata* is a very weedy species, found usually in the open or in light shade beside ditches and streams, often very abundantly. Individual plants may be very bushy, with two dozen or more flowering stems. *Viola striata* is placed with the stemmed blue violets because it appears to be more closely related to them both morphologically and genetically than to the stemmed white violets, which it resembles in petal color. It has been observed to hybridize with stemmed blue violets but not with stemmed white species.





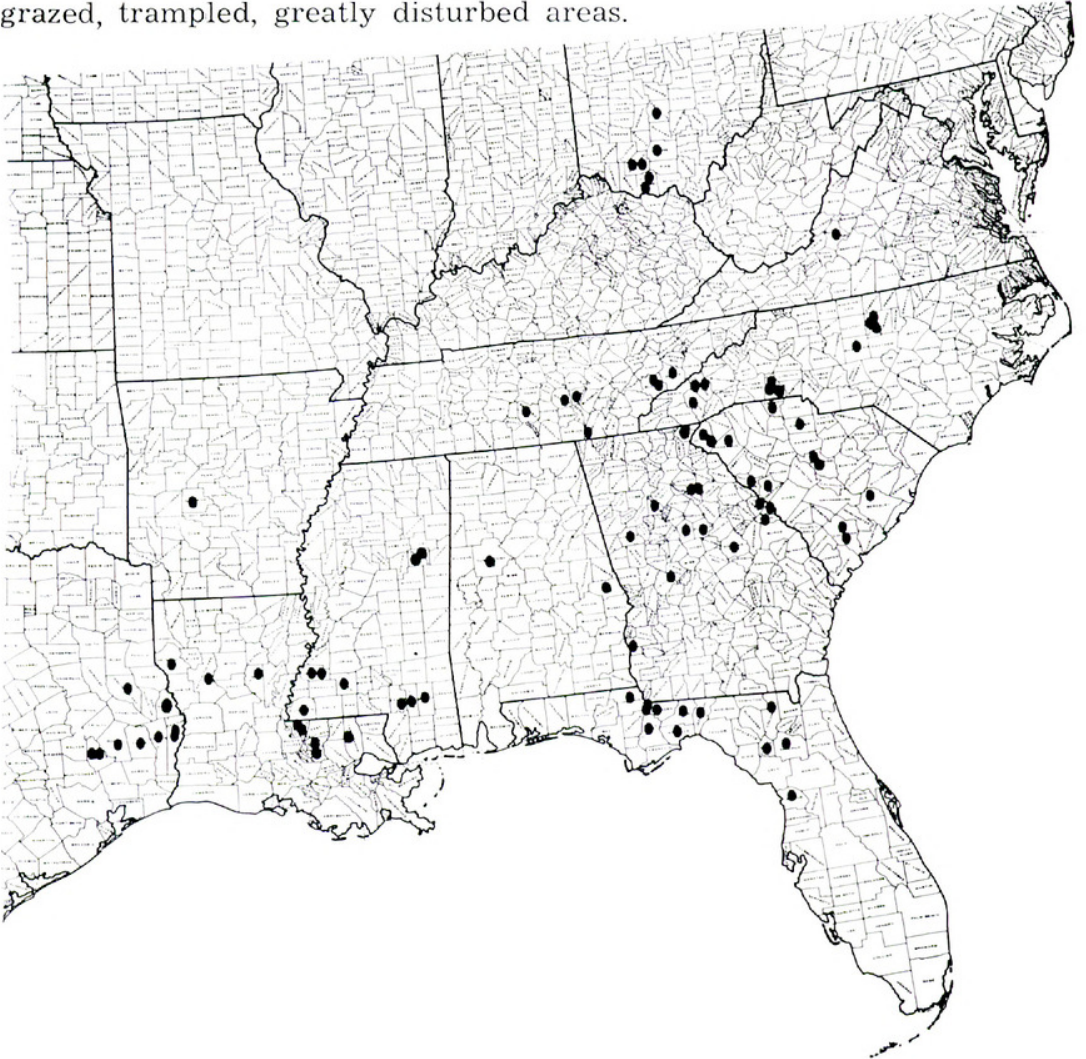


6. *Viola walteri* House, Torreyana 6: 172. 1906.

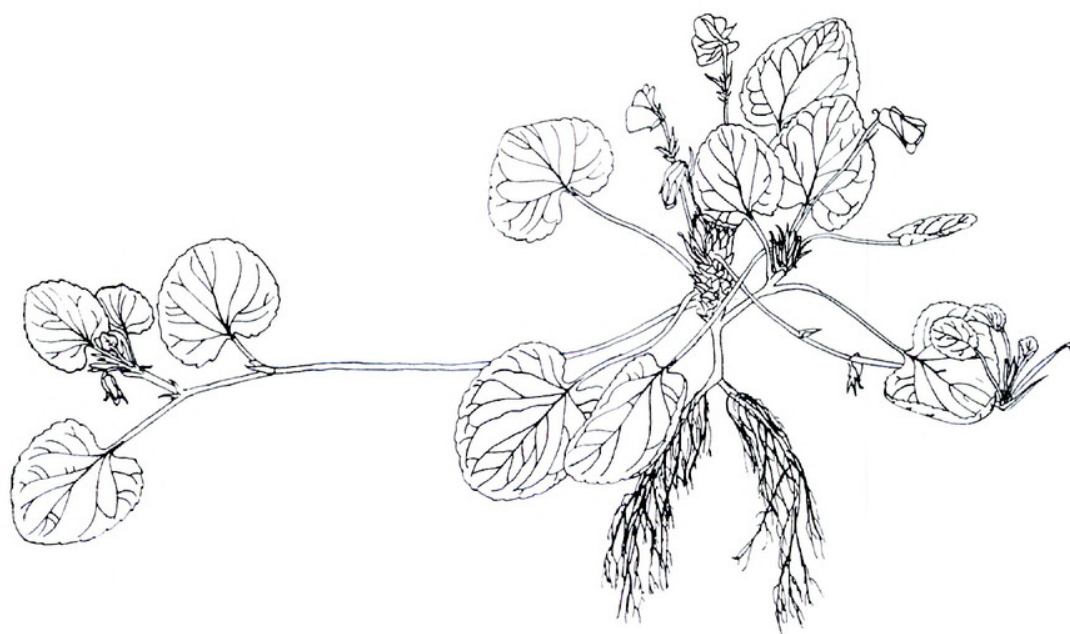
I consider this to be one of the most beautiful of the violets, particularly when seen on rich wooded slopes in Georgia and northern Florida in late spring or summer. It sends out long stolons which root at the nodes and send up new crowns. Frequently the leaves, especially the veins, become suffused with purple, adding to its attractiveness.

It is probably closely related to *V. conspersa* with which it intergrades both in the mountains of southeastern Tennessee and in southern Ohio. Many specimens from these areas are difficult to assign to either species.

Several disjunct and somewhat peculiar colonies of this species occur in northern West Virginia, western Maryland, and southwestern Pennsylvania. I have visited the colonies in Monongalia County, West Virginia and made large collections. These plants have been given the names of *V. appalachiensis* and *V. allegheniensis* and were earlier thought to be *V. labradorica* (Platt, 1950). In the field the specimens appeared to me to be either depauperate plants of *V. conspersa* or *V. walteri* bordering on *V. conspersa*. The plants grew in open or partly shaded, grazed, trampled, greatly disturbed areas.





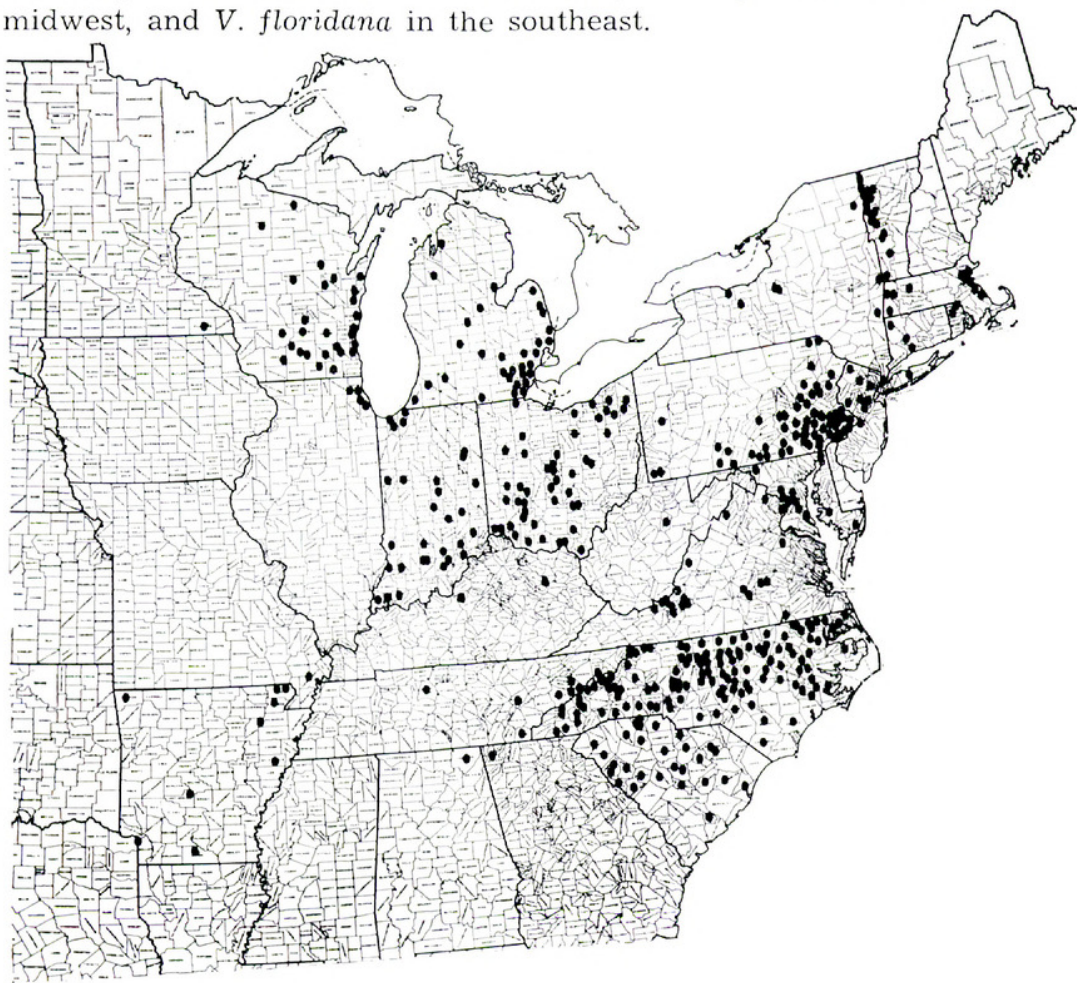


## GROUP II. STEMLESS BLUE VIOLETS.

7. *Viola affinis* LeConte, Ann. Lyc. N.Y. 2: 138. 1826.

*Viola affinis* is one of the commonest of northeastern violets, much more so than has been supposed by most taxonomists. One reason for this is that many specimens of the mythical eastern *Viola papilionacea* (see discussion of *Viola pratensis*) actually belong to *V. affinis*. Because of its similarity to some other species, notably *V. sororia*, *V. nephrophylla*, and *V. cucullata*, it is often misidentified. It is found in deciduous woodlands, not in open fields or bogs as *V. nephrophylla* and *V. cucullata* often are. It also differs from both these species in having the peduncles about equalling (not exceeding) the petioles, and the cleistogamous fruits on prostrate (not erect) peduncles. It differs from *V. sororia* most markedly in pubescence. *Viola affinis* has conspicuous areas of stiff, scattered white hairs on the upper surfaces of the basal lobes of the leaf, a condition never found in *V. sororia*, in spite of the many leaf pubescence patterns of this species.

*Viola affinis* is a member of a complex which consists of five fairly well-marked violets. In this work I continue to treat them as species, though eventually it may be more useful to consider them subspecifically. They are: *V. affinis* in the northeast, *V. missouriensis* in the midwest, *V. viarum* in the far midwest, *V. langloisii* in the southern midwest, and *V. floridana* in the southeast.





In the maps the range limits of each species are provisional and arbitrary. Where any one of these meets another, there is an insensible intergradation, and annotations of specimens are arbitrary. In western Indiana and Illinois, *V. affinis* and *V. missouriensis* grade into each other, and in southern North Carolina and South Carolina *V. affinis* and *V. floridana* are virtually indistinguishable.

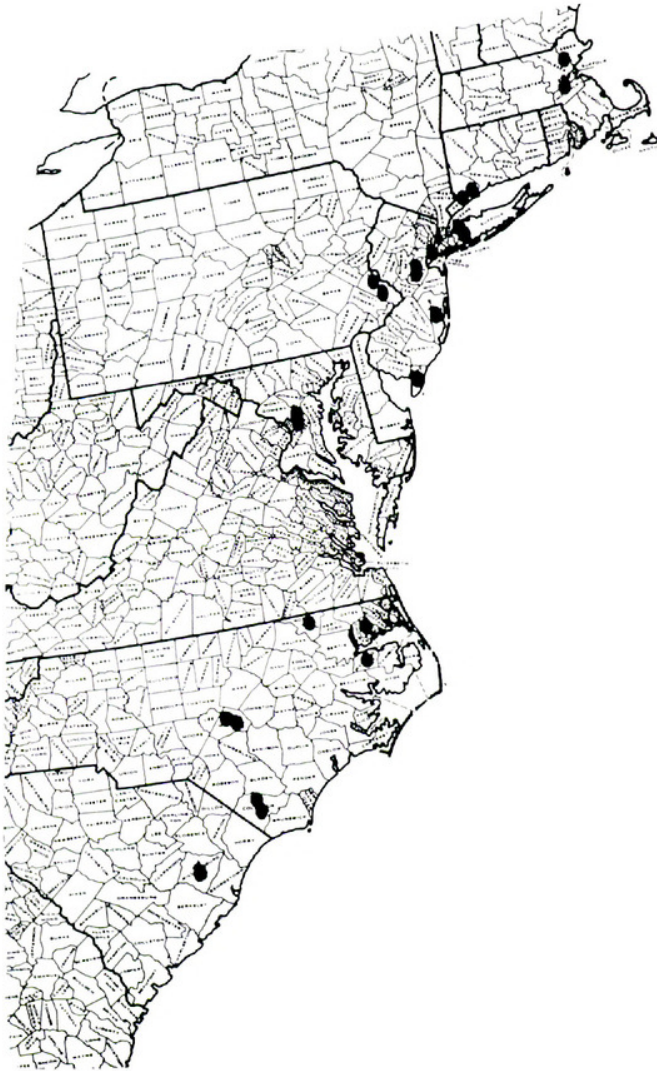


Fernald (1950) lists eleven other species with which *V. affinis* has been said to hybridize. A particularly frequent hybridization with *V. sagittata* gives rise to many of the plants previously called *V. emarginata* (see excluded species).

*Viola rosacea* Brainerd differs from typical *V. affinis* only in petal color, a richer, reddish purple. Color forms such as this are frequent among the stemless blue violets and do not, in my opinion, deserve names unless they are accompanied by other differences. I have seen Brainerd's specimens from Mississippi and have collected, with Prof. Joseph Ewan, in the vicinity of Crowley, Louisiana, the type locality.

8. ***Viola brittoniana*** Pollard, Bot. Gaz. 26: 332. 1898.

This interesting violet is found occasionally on the northeastern coastal plain, where it replaces the southeastern *V. septemloba*. *Viola brittoniana* occurs as far south as Orange County, North Carolina, where I have collected it in sandy soil beside a stream.





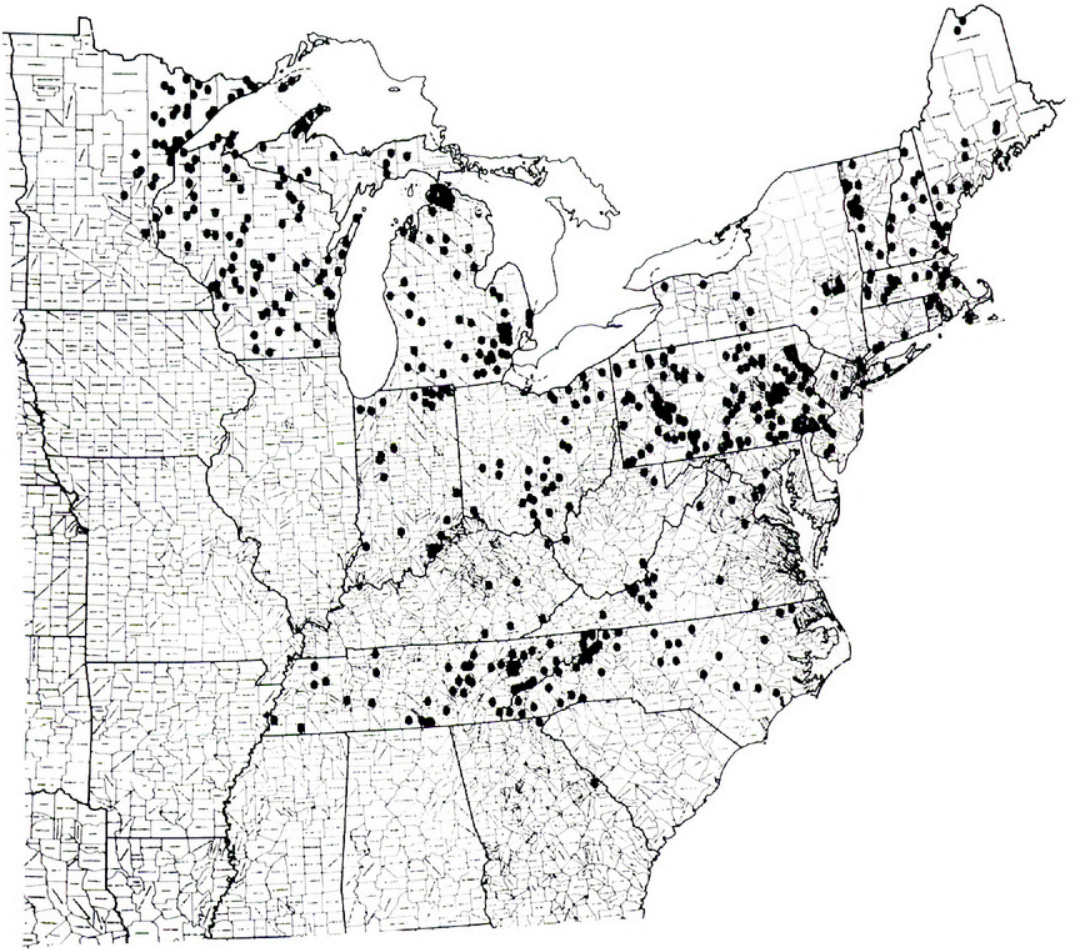
Sometimes growing with the typical plants with their deeply dissected leaves are plants with elongated, triangular leaves with especially deep crenations near the base (pectinate). They resemble some of the *V. sagittata* hybrids that have gone under the name of *V. emarginata* (see excluded species). Presumably this is not a case of hybridization but instead of genetic dimorphism.



9. *Viola cucullata* Ait., Hort. Kew. 3: 288. 1789.

This is one of the most familiar, beautiful, and distinctive of eastern violets. It is sometimes called the bog violet. It occurs in a variety of habitats, all moist; these include true bogs, swampy areas both open and forest, and sandy soil and rock crevices beside creeks through deciduous and evergreen forests. It may be distinguished by light blue flowers on very long peduncles (in shaded areas), which somewhat surpass the petioles in spring. The lateral petals have conspicuous beards of knobbed (clavate) hairs. The cleistogenes are sagittate, and the sepals have pronounced posterior extensions or spurs. Leaf blades tend to be cordate to slightly reniform. The leaves do not grow to the large size of such species as *V. sororia* in the late summer.

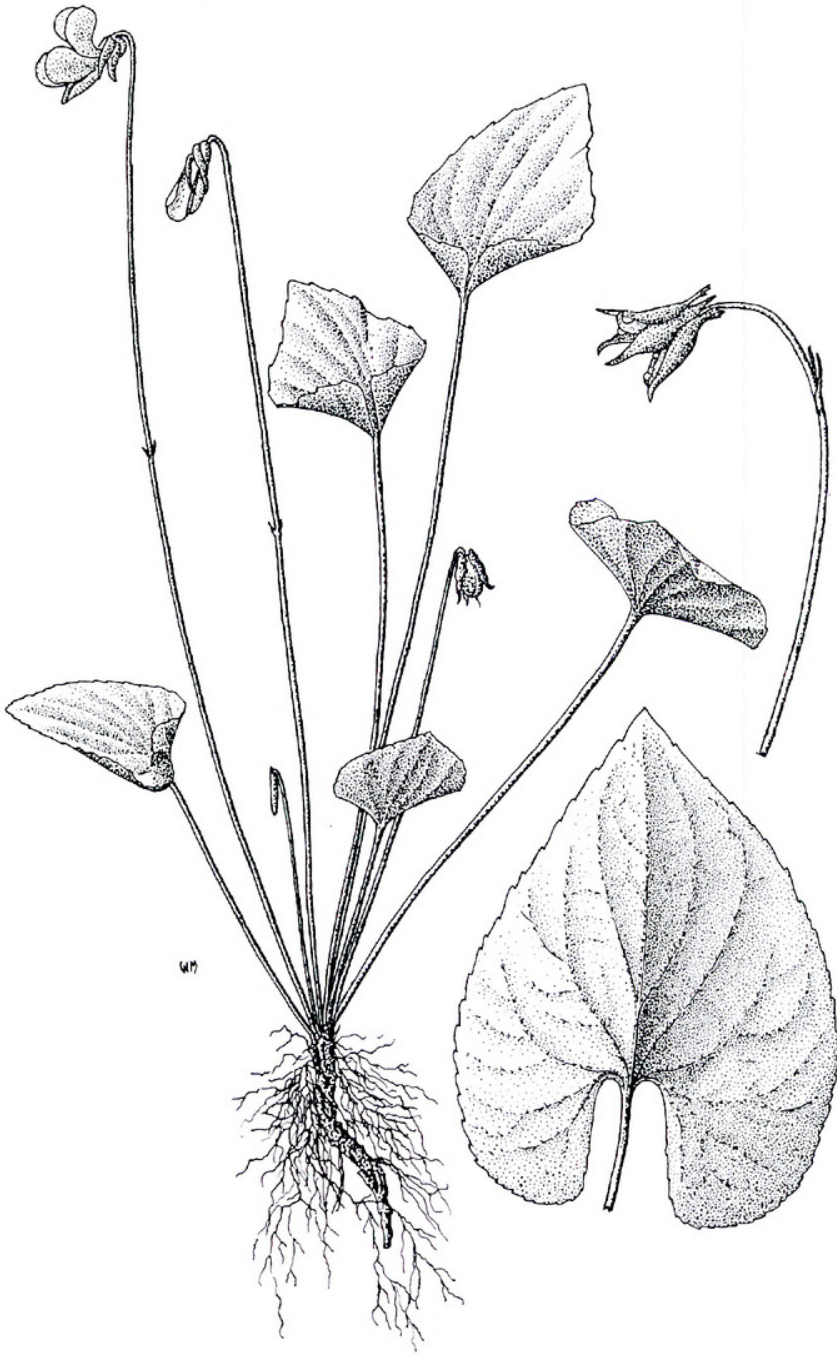
*Viola cucullata* is known to hybridize with many other stemless blue violets when it grows near them. It is frequently strongly modified as a result of this. For example, on the Helderberg Plateau in eastern New York, it commonly hybridizes with *V. septentrionalis* and has been greatly changed as a result of much introgression (Russell, 1955c). I found no pure populations of either species in this region, though I





analyzed samples of 32 populations. Species distinctions between the two were virtually eliminated there. In addition hybrid swarms between *V. cucullata* and *V. fimbriatula* or *V. sagittata* are occasionally found in the eastern states. The purest or least genetically disturbed *V. cucullata* plants I have seen were at the summit of Roan Mountain, Carter County, Tennessee, where no other stemless blue violets grew.

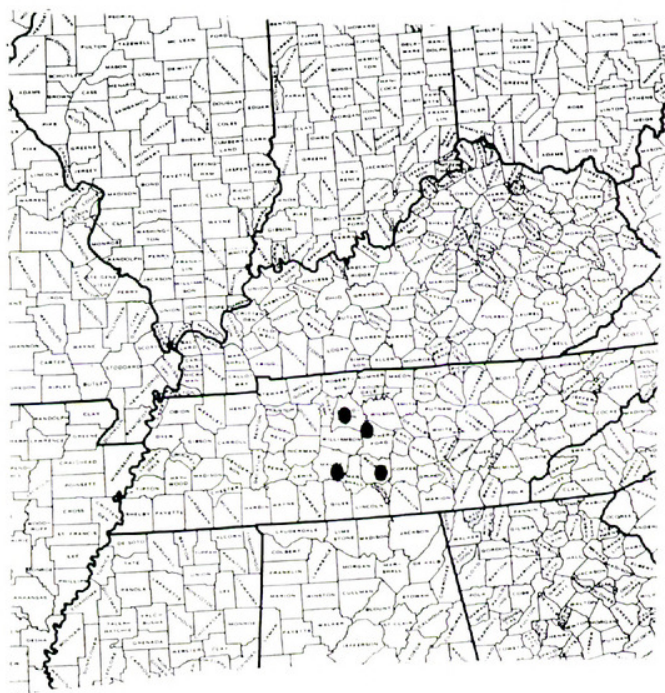
*Viola cucullata* is replaced in the midwest by *Viola pratincola*, with which it intergrades along the zone of contact. This will be discussed in more detail under *V. pratincola*.



10. ***Viola egglestonii*** Brainerd, Bull. Torr. Bot. Club 37: 526—527, pl. 34, 35. 1910.

This rare and peculiar violet has been found only in the cedar barrens of central Tennessee, where it is not at all common. I have visited this area and with the aid of Dr. Ben Channell found and sampled populations near Nashville. Brainerd (1921) cites a specimen from Bowling Green, Kentucky, which I have not seen or mapped.

This species is not very similar to other stemless blue violets. Morphologically the leaves resemble most closely those of *V. septemloba* in their lobing pattern, but there are many differences.



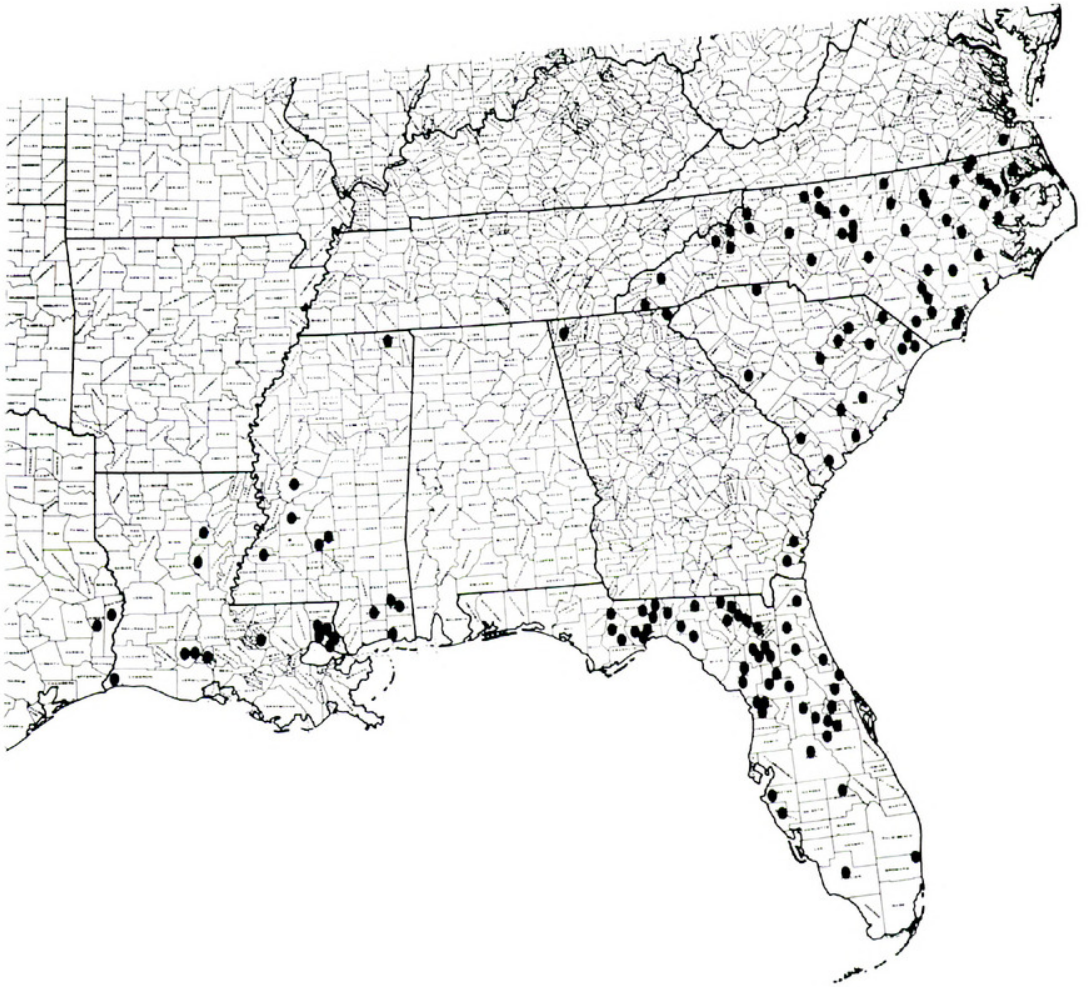




11. **Viola esculenta** Ell., Sketch Bot. S.C. & Ga., 1: 300. 1817.

*Viola esculenta* is common on the southeastern coastal plain, where it may be confused with *V. septemloba*. It differs in the shape of the leaf lobes. The lobes of the leaves of *V. esculenta* are broadly obovate and usually only 3 or 5 in number; *V. septemloba* commonly has 7-9 slightly oblanceolate lobes. The two species often grow side by side, but I have seen no evidence of natural hybridization between them. However, I do believe that *V. esculenta* hybridizes with *V. floridana*, and that this is responsible for the many variations in leaf lobing.

The leaves of *V. esculenta* occasionally tend to be slightly succulent and the sepals may have spurs or auricles which are long and emarginate, but I have not found either of these to be very reliable characteristics. Its closest morphological relative may be *V. floridana*.



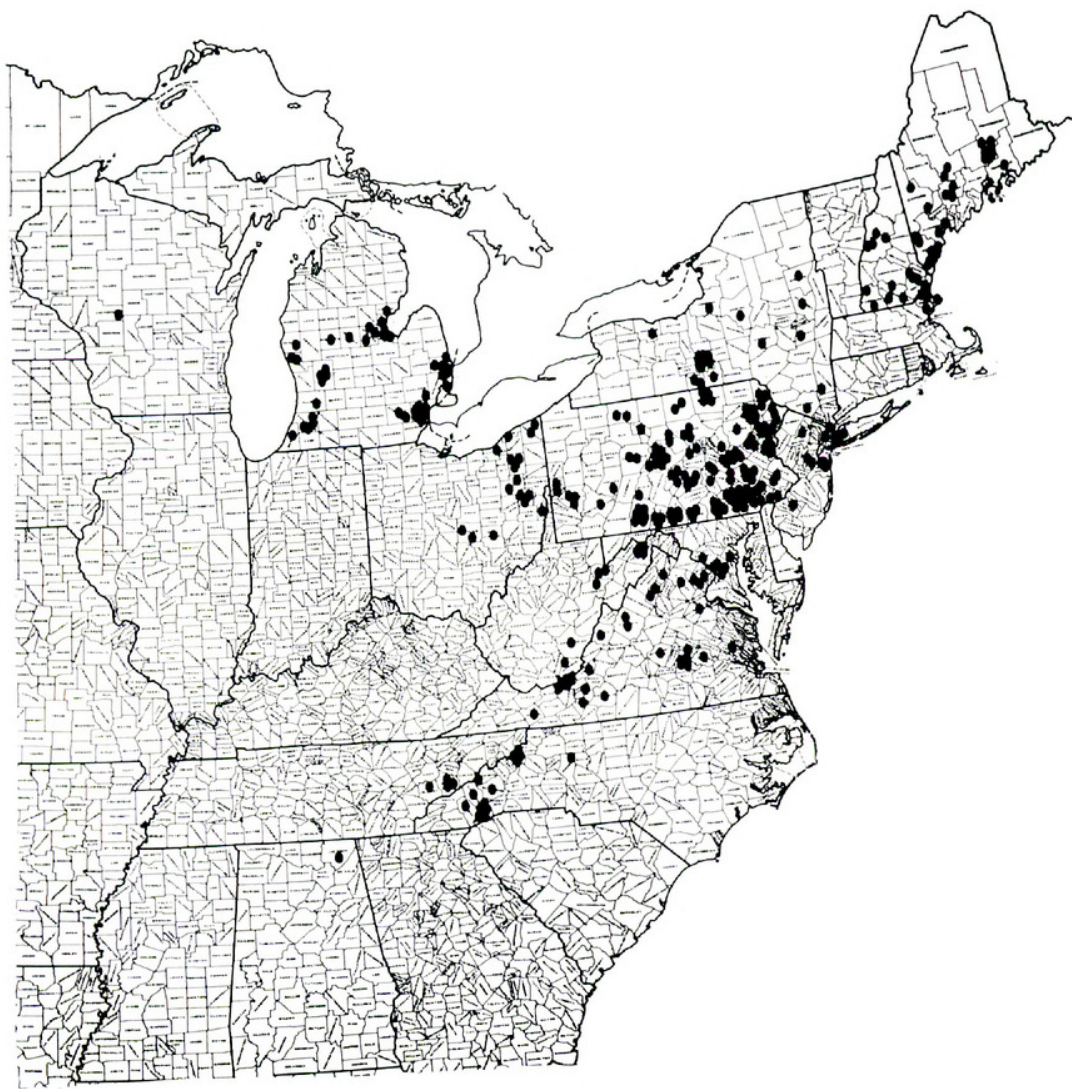




12. *Viola fimbriatula* J. E. Smith in Rees, Cyclopaedia 37: Viola no. 16. 1817.

My observations of herbarium specimens and field populations of this species have led me to believe that it is more distinct than has been supposed. Brainerd (1921, 1924) remarked upon its "confluence" with *V. sagittata* and analyzed cases of hybridization between the two species. More frequent than hybrids in nature, I believe, are dwarfed specimens of *V. sagittata* which can be mistaken for *V. fimbriatula* or for hybrids.

The two species differ in several characters. *Viola fimbriatula* has leaves with the blades sometimes twice as long as the stunted petioles; *V. sagittata* has, at least in late spring and summer, petioles several times as long as the blades. The mature blades of *V. fimbriatula* are usually only obscurely toothed at their bases; those of *V. sagittata* are deeply toothed. The plants of *V. fimbriatula* are heavily pubescent with long hairs; those of *V. sagittata* less pubescent to glabrate, with shorter





hairs. *Viola sagittata* is usually found growing in moist, sandy fields in full sunlight. *Viola fimbriatula* is more at home in open forests or at the edges of forests. In the southern Appalachians, *V. fimbriatula* is found at higher elevations. I would suspect that *V. fimbriatula* has a mountain ancestry and *V. sagittata* a coastal plain and piedmont history.

*Viola fimbriatula* may hybridize with several other stemless blue violets in nature, notably *V. cucullata* and *V. septentrionalis* in northeastern United States (Russell, 1955c).

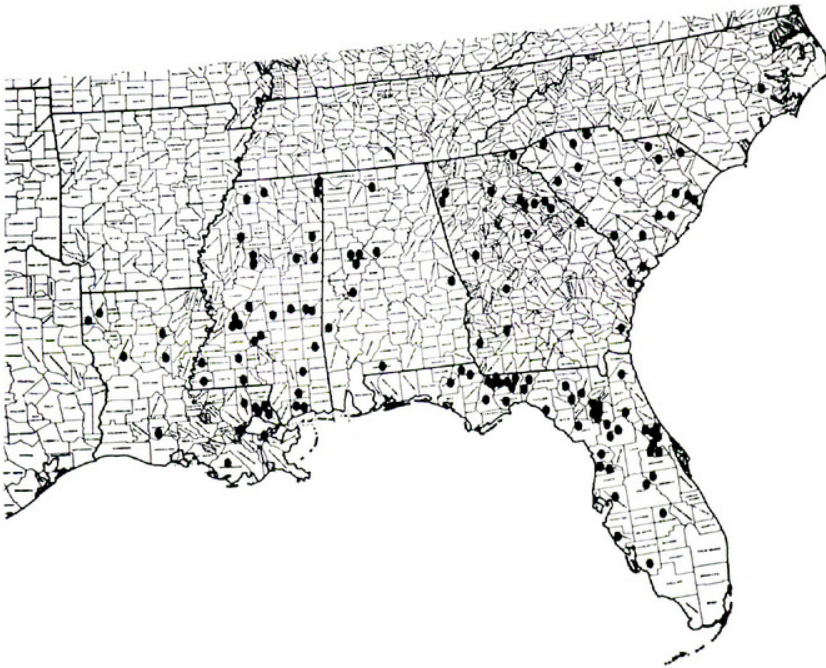


13. ***Viola floridana*** Brainerd, Bull. Torr. Bot. Club 37: 524. 1910.

The southeastern member of the *V. affinis* group (see that species for discussion) is a beautiful violet found most abundantly in Florida. *Viola floridana* is very similar to *Viola affinis*, differing in having slightly smaller leaves, these slightly fleshy, and with flowering peduncles distinctly overtopping the leaves. To the west the plants become smaller and pass into *V. langloisii*. To the north, *V. floridana* grades into *V. affinis* in South and North Carolina.

Identification of *V. floridana* on the southeastern coastal plain is often complicated due to occasional hybridization with the cut-leaved *V. esculenta*. Both species show the effects of introgression. In addition it may occasionally hybridize with *V. sororia*.

I have examined the type of *V. chalcosperma* Brainerd and other specimens from the type area, and I am unable to separate it from *V. floridana*. Some seeds do tend to a bronze color, but this is a quantitative difference and hardly sufficient to distinguish a species.



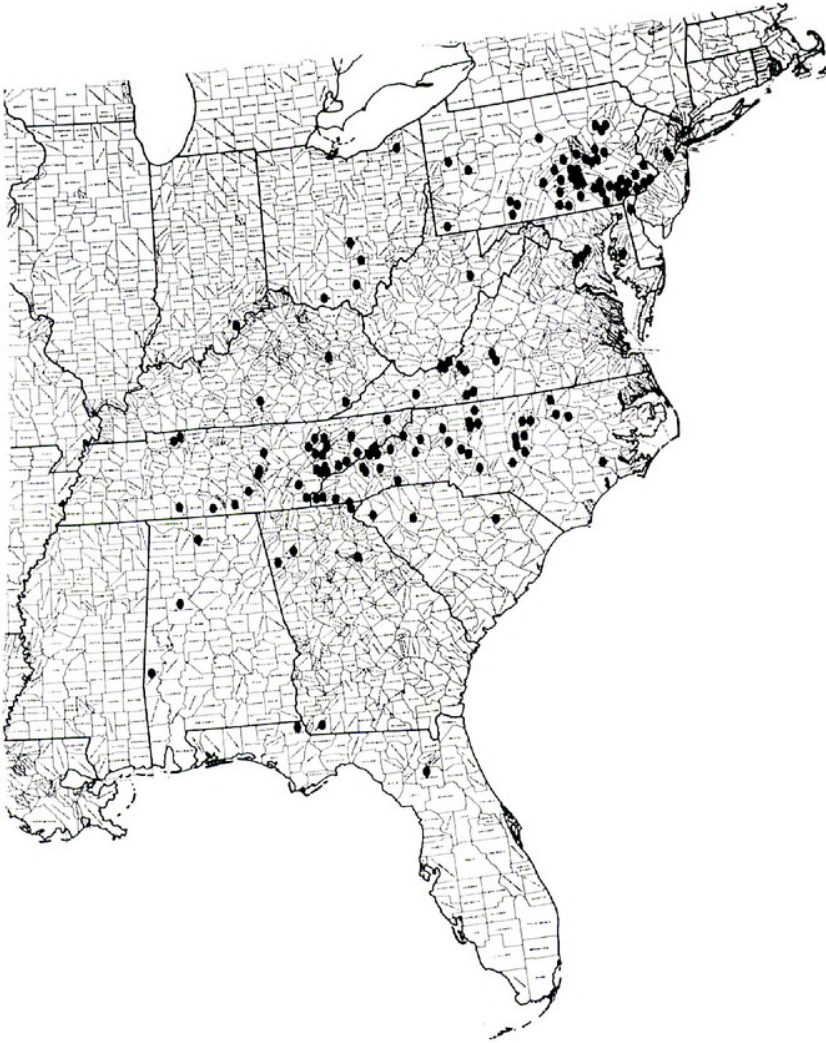




14. ***Viola hirsutula*** Brainerd, Rhodora 9: 98. 1907.

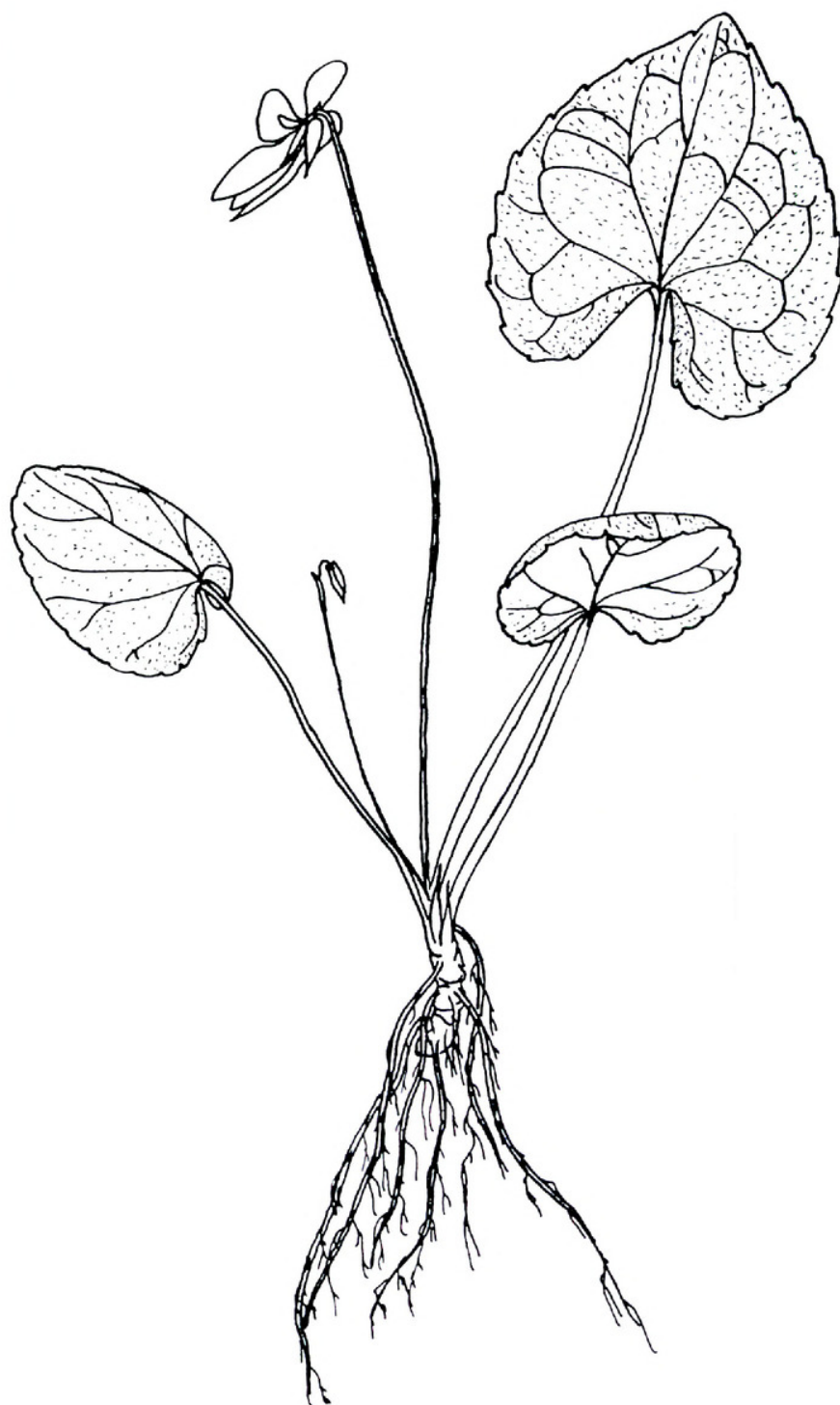
*Viola hirsutula* is one of the most attractive of the violets when it is not affected by hybridization. The oval leaves have the veins suffused with purple and are covered with a thick mat of stiff white hairs on their upper surfaces. In Tennessee and Virginia I have learned to look for it in old, relatively undisturbed pine forests. Farther northward it may occur in rich, relatively dry, deciduous forests. Usually it occurs sparingly, as scattered plants, but occasionally may form most of the carpeting of a forest. It had a long and tortuous nomenclatural history which was reviewed by Brainerd (1921). It is difficult now to understand how it could have been confused with the very different *V. villosa*, with which it sometimes grows in the southeast.

*Viola hirsutula* appears to be quite distinct from other stemless blue violets. It certainly does not closely resemble *V. sororia* and *V. villosa*, with which it has been confused. To me it is most similar morphologically to *Viola nephrophylla* of the north and west.





This species frequently hybridizes with other stemless blue violets (see Brainerd, 1924), producing sometimes an interesting display of backcrosses, particularly when its partner is a cut-leaved species.

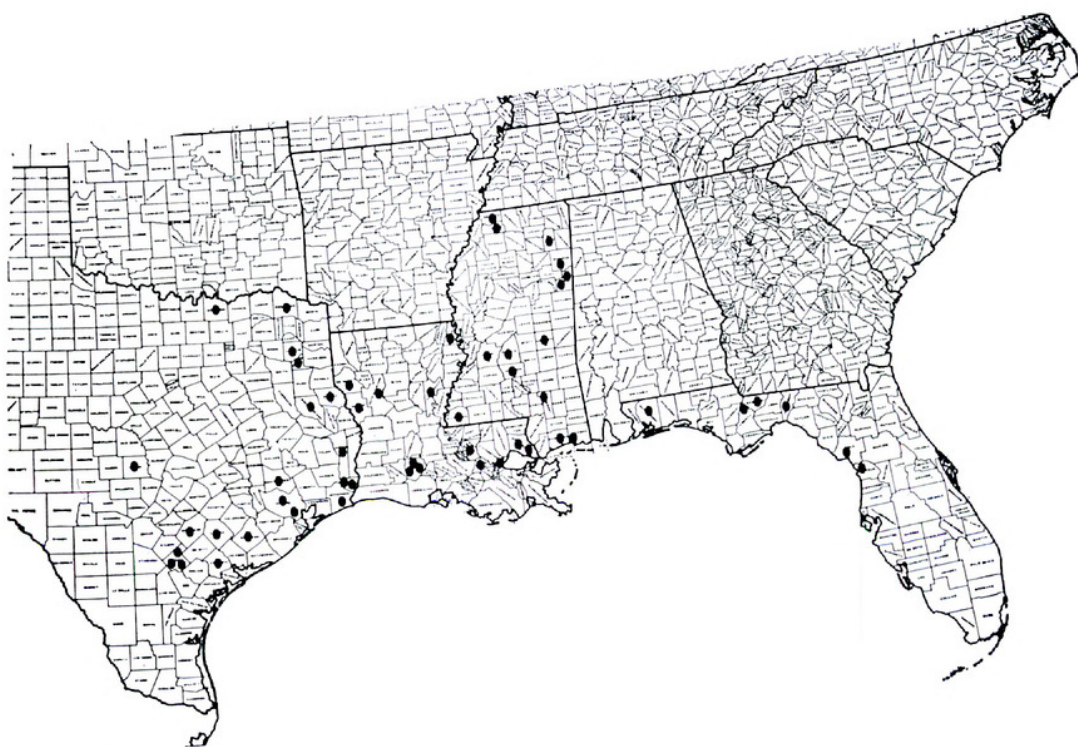


15. ***Viola langloisii*** Greene, Pittonia 3: 87. 1896.

Brainerd (1921) remarks that *V. langloisii* is closely related to *V. affinis*. It is even more similar to *V. missouriensis*, from which it can hardly be separated in Texas and western Louisiana. Farther to the east, it grades into *V. floridana* in Mississippi and west Florida.

Its distinguishing features are the tiny, triangular leaves and the flowering peduncles two or three times as long as the leaf petioles. I have no drawing of it. The reader is referred to Brainerd's excellent plate (Brainerd, 1921, Species No. 18, page 50).

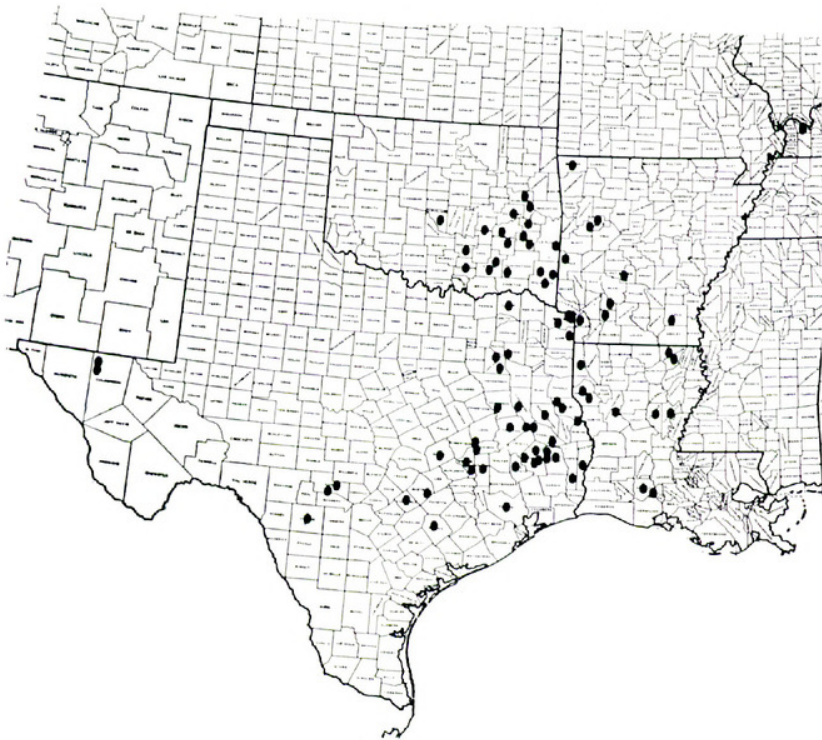




16. ***Viola lovelliana*** Brainerd, Bull. Torr. Bot. Club 37: 526. 1910.

In the southwest the *Viola sagittata* complex is represented by a small, distinctive violet first recognized and named by Ezra Brainerd. The type locality is near Crowley, Louisiana, where I have also collected it. Northward it grades into *V. sagittata*, not into *V. triloba*, as Brainerd (1921) suggested. Its leaves tend to become more triangular with a lessening of the pronounced basal lobing. It does not have the heavy, long pubescence of *V. triloba* and *V. sororia*, instead being puberulent or glabrate, as *V. sagittata* is in this area.

*Viola lovelliana* grows in open, disturbed forests of pine and mixed hardwoods, often with such other violets as *V. villosa*, *V. walteri*, and *V. langloisii*. I do not know whether or not it hybridizes with them. My limited observations suggest that it does not.





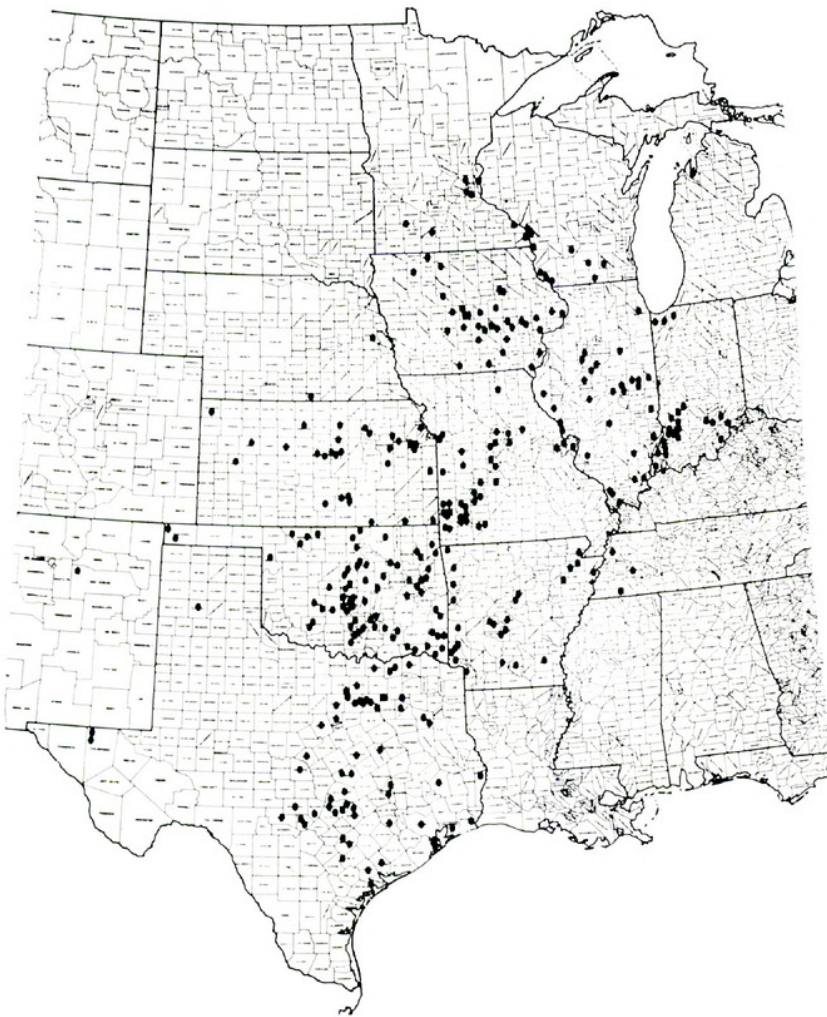


17. ***Viola missouriensis*** Greene, Pittonia 4: 141. 1900.

This interesting midwestern violet is found abundantly in most of its range in moist creek or river woods, where it grows on sandy or silty floodplain soils. It often forms large, dense colonies. It seems to be especially abundant in forests where cattle grazing has been heavy, perhaps because it has been released from competition with less hardy native species of plants. It is also frequently found as a weed in towns and cities.

In the midwest *V. missouriensis* may be confused with *V. sororia* and *V. pratincola*. Unlike *V. sororia*, its leaves, when not disturbed by hybridization, are entirely glabrous. In addition the leaf shape is distinctive. The apex is bluntly attenuate and the margins of the apical portion have only 1-3 teeth (crenations) on each side. In both *V. sororia* and *V. pratincola*, the number is 8, 10, or greater. *V. pratincola* differs also in having a sharply acute apex and in growing in open, dry, prairie-like habitats, never in stream forests.

In the upper midwest pure populations of *V. missouriensis* are difficult, if not impossible, to find. Growing with *V. missouriensis* in nearly





every creek forest is *V. sororia* Willd., and the two appear to require only physical proximity for hybridization and extensive introgression (Russell, 1958a). Both are markedly affected by this, and it is discussed in more detail under *V. sororia*.

In towns and cities *V. missouriensis*, *V. sororia*, and *V. pratensis* may grow together as weeds, and all may hybridize, producing bizarre mixtures.

To the west *V. missouriensis* grades into *V. viarum* (see discussion under that species), and to the south it merges imperceptibly with *V. langloisii*. To the northeast, in Wisconsin, Illinois, and Indiana, it merges with *V. affinis*. Its relationships with these species and with *V. floridana* are discussed under *V. affinis*.

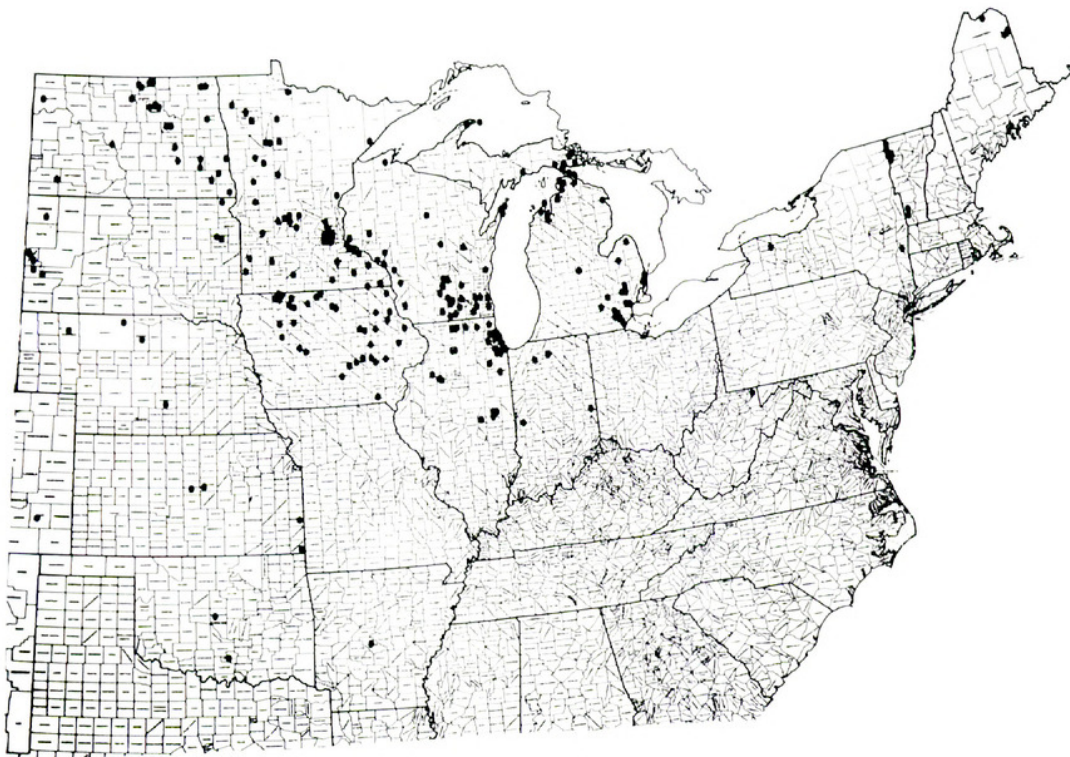


18. ***Viola nephrophylla*** Greene, Pittonia 3: 144—145. 1896.

One of the most widespread of North American violets, *V. nephrophylla* plants vary in leaf form and pubescence and other characteristics from place to place but in a rather haphazard fashion. Variation is greatest in the western mountains where several varieties or additional species were named, principally by E. L. Greene. A detailed analysis of herbarium and population sample material by Frank S. Crosswhite and myself (Russell and Crosswhite, 1963) failed to reveal any justification for the recognition of these names. In eastern and north central United States *V. nephrophylla* occurs along rocky shores and in wet, grazed meadows, always in the open.

*Viola nephrophylla* has several distinguishing features. In the spring the earliest leaves are oval or slightly reniform and almost invariably purplish underneath (reminiscent of *V. hirsutula*). In the summer the larger leaves are slightly reniform and about half the size of the leaves of other stemless blue violets. The flowering peduncles are about half again as long as the petioles. The spur petal is villous most of the time, but this is not always a reliable characteristic. The leaves have fine hairs on the upper surfaces of the basal lobes and are glabrous elsewhere, a characteristic shared with *V. cucullata*. Other pubescence patterns are found in Rocky Mountain *V. nephrophylla*.

*Viola nephrophylla* may hybridize with other species, but it does not often grow with them, so hybridization has apparently not yet modified the species. I reported upon a case of hybridization between *V.*





*nephrophylla* and *V. missouriensis* (mistaken for *V. pratincola* in the study) in southern Minnesota (Russell, 1952), and have seen hybrid swarms with *V. sagittata* in Wisconsin.

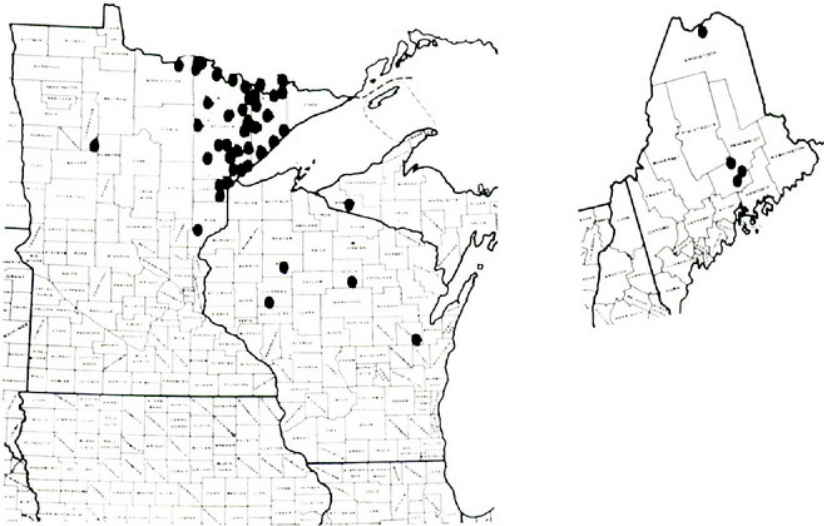
Its nearest relative may be the southeastern *V. hirsutula*. However, it is quite distinct from all the other stemless blue violets.





19. ***Viola novae-angliae*** House, Rhodora 6: 226, pl. 59. 1904.

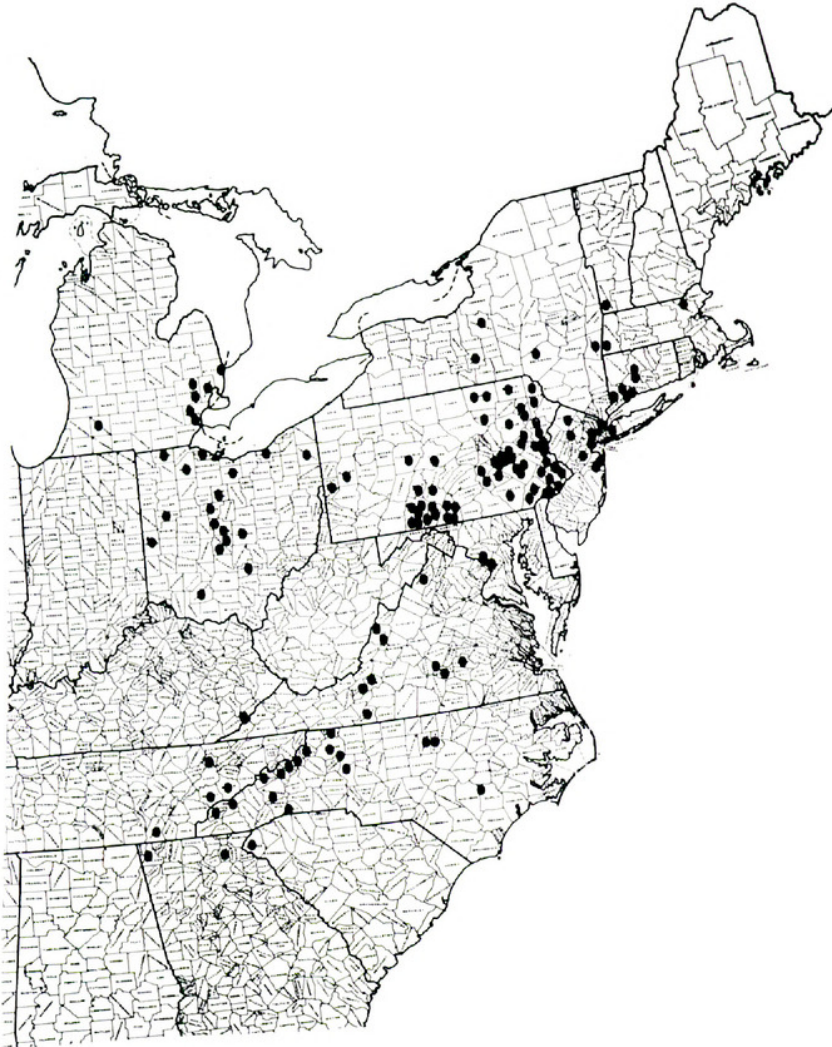
This species, originally collected in northern Maine, grows best along the north shores of the Great Lakes, in rock crevices along shore, or beside cold, rapidly flowing streams. In northern Wisconsin and Minnesota, where I am most familiar with it, it grades into *V. sagittata*, and the two species are hard to separate. Characteristically its leaf blades are not toothed but small, and somewhat triangular.





20. ***Viola palmata*** L., Sp. Pl. 933. 1753.

This essentially Appalachian violet is relatively uncommon, occurring occasionally in relatively dry, open, deciduous forests. It may be confused with *V. triloba*, but differs in its deeper, somewhat pinnate lobing. Its similarities to *V. pedatifida*, which replaces it in the midwestern prairies, are discussed under that species. *Viola palmata* may hybridize with other species of stemless blue violets, rendering it difficult to determine. In Brainerd's monograph one of his plates of *V. palmata* (Brainerd, 1921, p. 17, Species 2b) actually portrays a plant of *V. esculenta*, perhaps with some introgression from a pubescent violet.



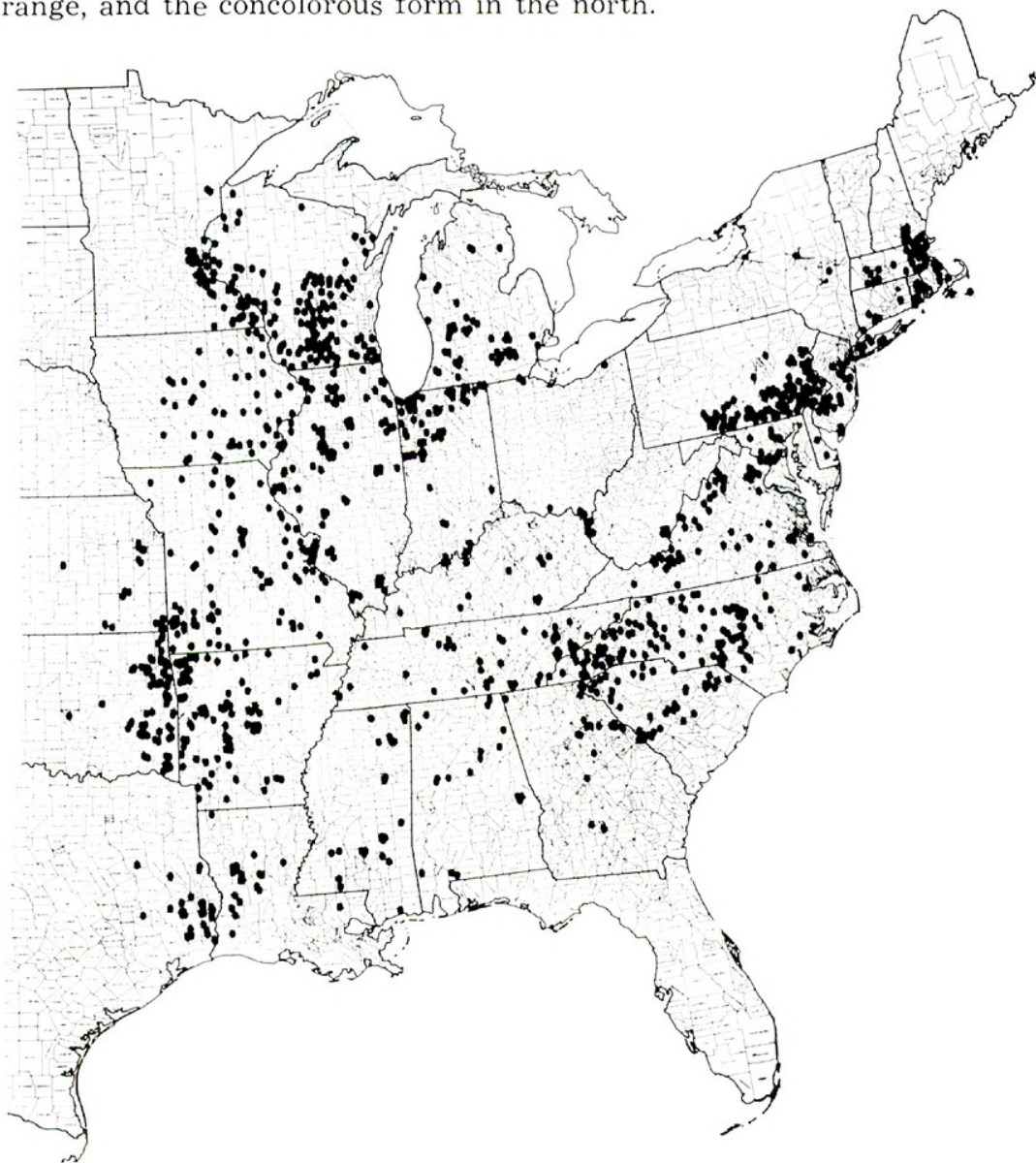




21. ***Viola pedata*** L., Sp. Pl. 933. 1753.

The bird-foot violet is the most frequently collected of all eastern violets, as its distribution map illustrates. It is actually less frequently seen in the field than such species as *Viola sororia* and *V. pubescens* var. *eriocarpa* however. It is usually found in open, sandy areas.

Morphologically, it can be distinguished by a short, thick, vertical rootstock, deeply pedately cut leaves, and the absence of cleistogamous flowers during the summer. The petaliferous flowers are exceptionally distinctive. The large, beardless petals assume a flattened aspect, seen elsewhere only in the cultivated pansies. There are two principal types of coloration. At one extreme the top two petals are dark purple, the three lower light blue. At the other extreme all five petals are light blue. The bicolorous form is more frequent in the southern part of the range, and the concolorous form in the north.





Most taxonomists have considered *V. pedata* to consist of two varieties, *pedata* and *lineariloba*. I have elsewhere discussed the status of these (Russell, 1959). The variety *lineariloba* supposedly designates a northern form with deeply lobed leaves and concolorous corollas. The growth of this type of leaf appears to be a response to the longer daylengths of summer. They are produced by *V. pedata* plants throughout the range of the species during the summer.



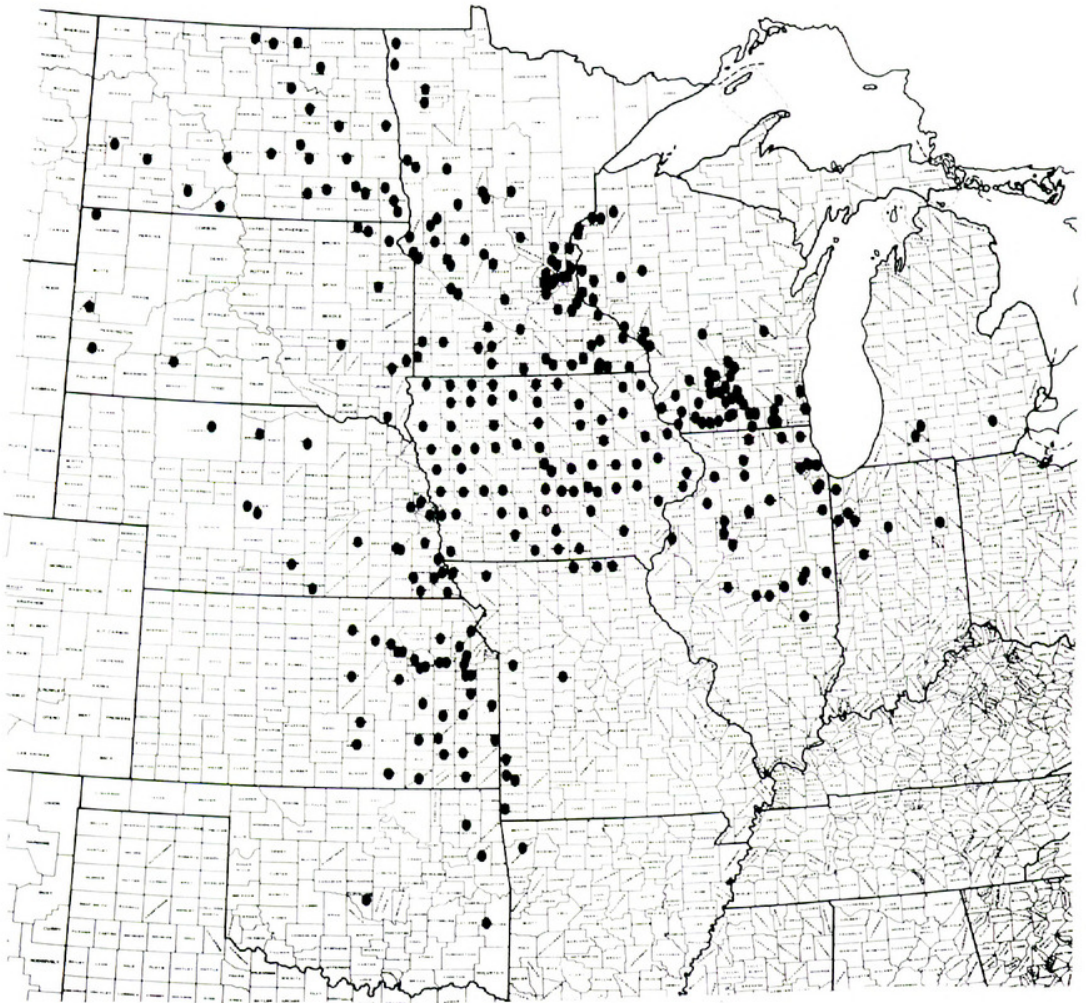


Many names have been proposed for several unusual flower and leaf forms found particularly in the southeastern United States (e. g., *V. Reidiae* Cory). These unusual forms sometimes occur in profusion in populations. In 1959 Mr. William Bowen and myself collected specimens from one such variable population seven miles east of Rockingham, North Carolina. As a result of our analysis we suggested (Russell and Bowen, 1960) that the peculiar variation was due to introgressive hybridization from *V. primulifolia*, with which it grew at this locality.

*Viola pedata* has long been considered to be very distinct from other violets and to have no close relatives. However, on morphological grounds, there are two other violets which resemble it: *V. septemloba* and *V. brittoniana*. Their similarities and ranges suggest that they form a small species complex, perhaps derived from a single ancestral forms.

**22. *Viola pedatifida* G. Don, General System 1: 320. 1831.**

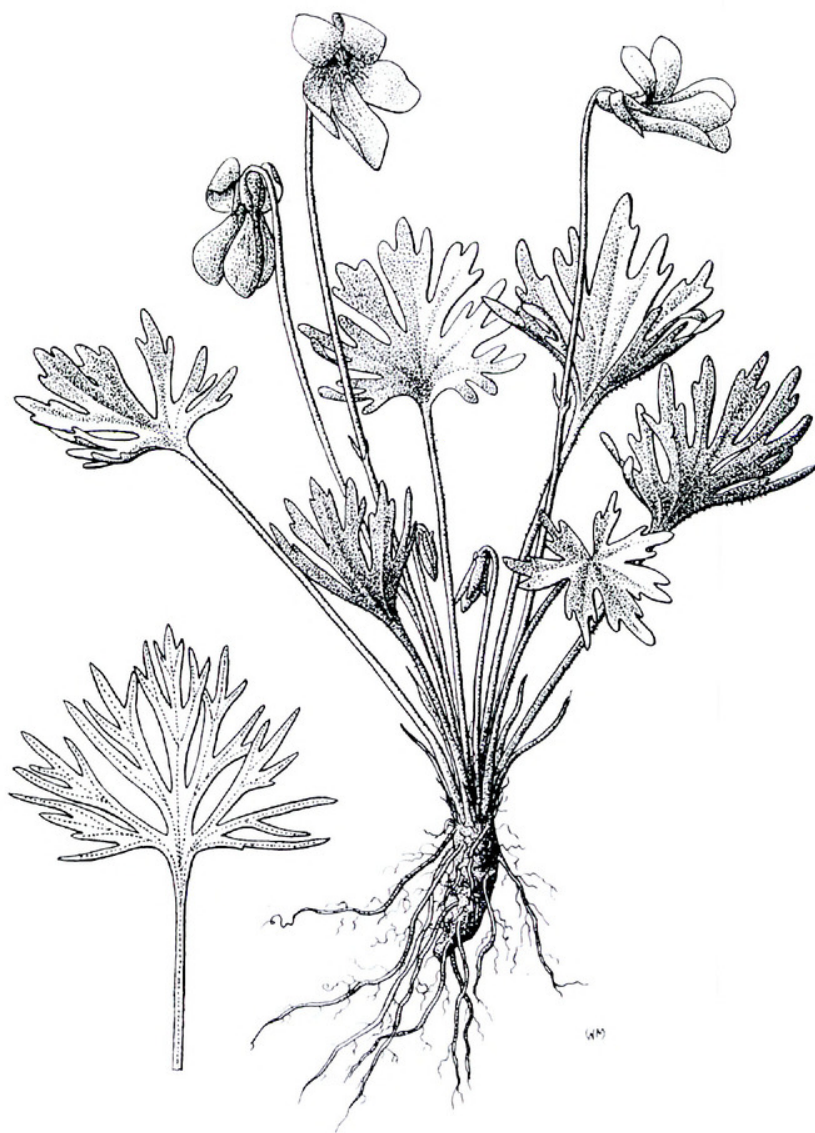
This violet is likely to be confused only with *Viola pedata*, with which it sometimes grows in the upper midwest. It differs in having the usual papilionaceous (pea-like) corolla, with the lateral and spur petals heav-



ily bearded. The leaves are not truly pedate, according to Brainerd (1921), having the middle segment divided in a somewhat pinnate fashion. In addition *V. pedatifida* produces cleistogenes during the summer.

*Viola pedatifida* is found in the true prairie, most often in grazed, burned, or otherwise disturbed open fields. It seems to grow most frequently on sandy soil.

Brainerd (1921) spoke of the similarity of *V. pedatifida* to *V. palmata* and mentioned Asa Gray's cognizance of this. I have observed it also. In southern Michigan, where the ranges of the two come together, they intergrade, and it is almost impossible to separate them. In the southeastern Appalachians, *V. palmata* is sometimes so similar to *V. pedatifida* that it is mistaken for it. The two species might easily be considered as varieties of a single species.

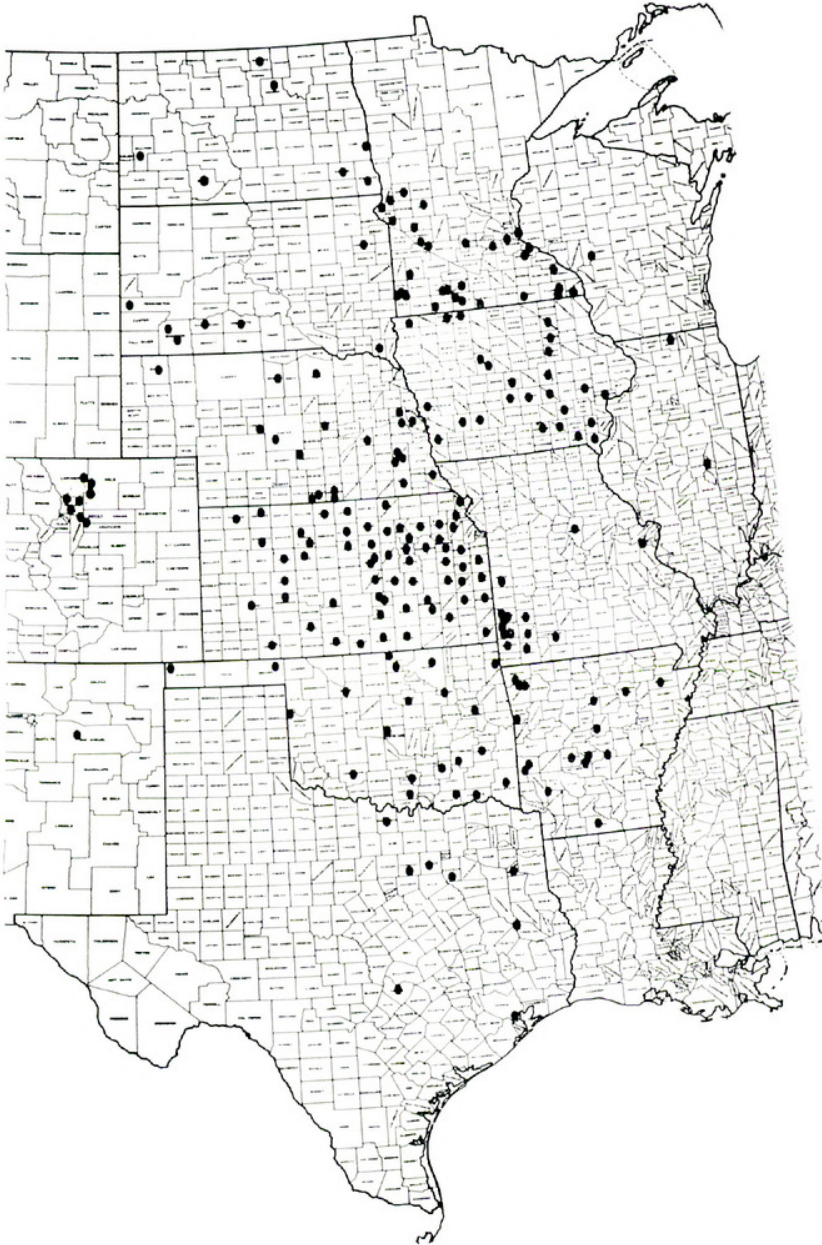




23. ***Viola pratincola*** Greene, Pittonia 4: 64. 1899.

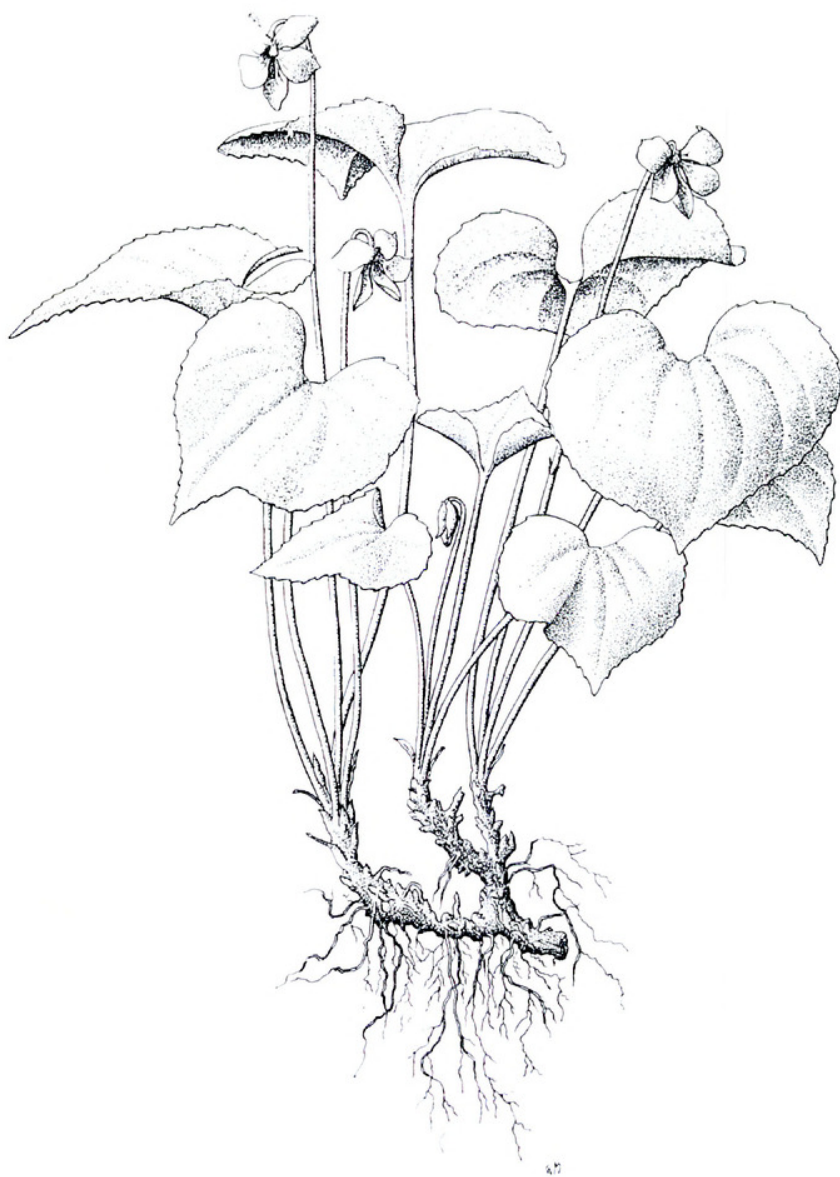
The name *Viola pratincola* was proposed by Greene for a midwestern violet thought to be a close relative of the well-known and common *Viola papilionacea* Pursh of the eastern and central United States. Subsequently most taxonomists concerned with wild violets have considered *V. pratincola* to be either a variety of *V. papilionacea* or, more often, not deserving of nomenclatorial status of any sort.

Fifteen years ago in Minnesota I found *V. pratincola* (or *V. papilionacea*, as I then thought it to be) quite distinct—a prairie margin violet, growing most frequently as a weed beside or in disturbed prairie tracts (especially on railroad banks in prairies) or frequently as a common lawn or sidewalk weed in towns and cities. I was able to trace this violet into Illinois and from there eastward my search for a species of violet





to fit Pursh's name of *V. papilionacea* has been futile. I have concluded that there simply is no such violet. All herbarium material so annotated is easily referable to other species, especially *V. affinis* and *V. sororia*. *Viola papilionacea* has been a myth, a catch-all for almost any glabrous or near-glabrous stemless blue violet with uncut leaves. *Viola sororia*, as discussed under that species, often has glabrous or near glabrous plants in the eastern states, either due to normal variation or as the result of introgression. Pursh described one of these variants for his new species.

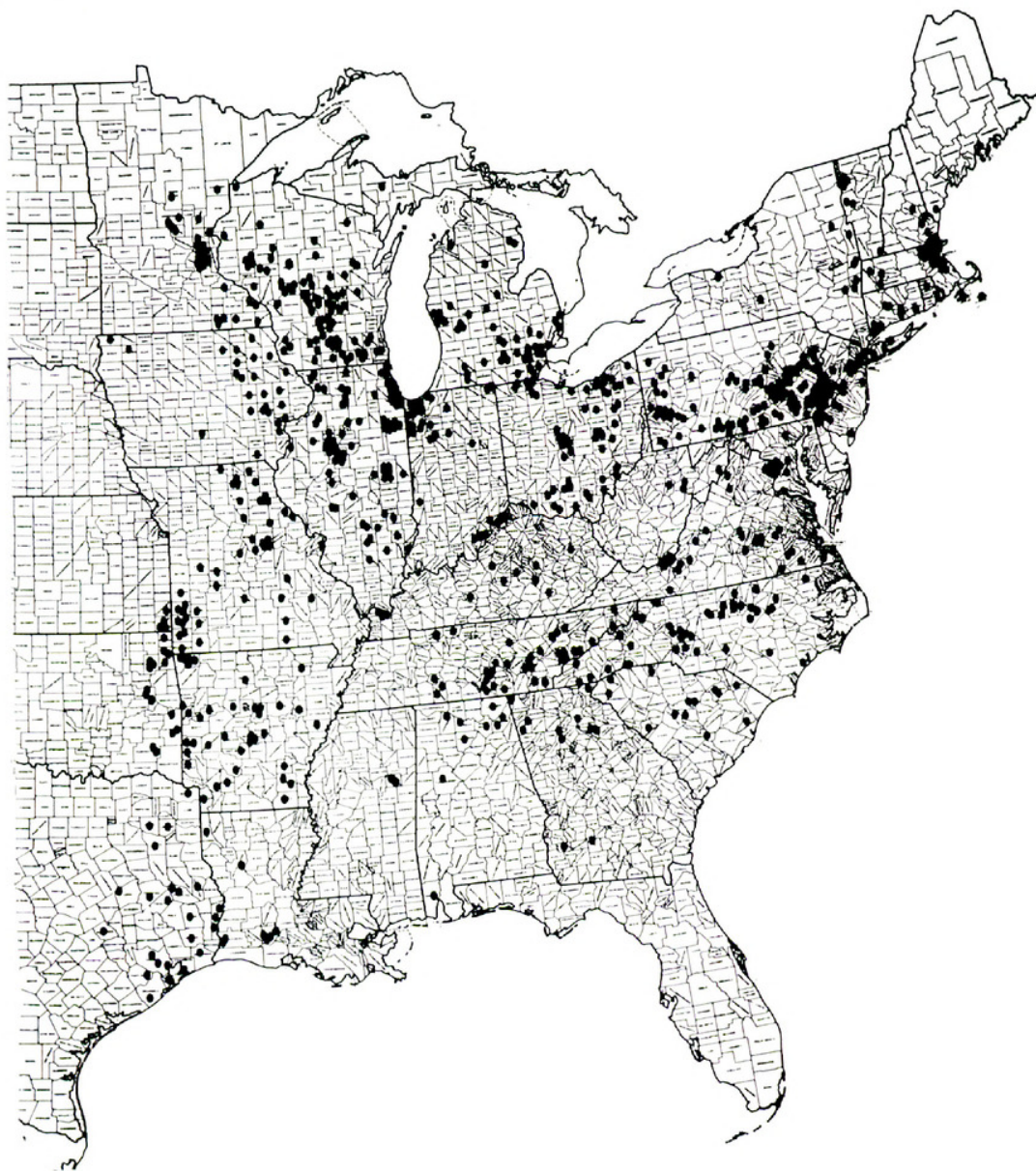


*Viola pratincola* bears close resemblance to *V. cucullata* of the east, when not affected by hybridization. The cleistogenes may be borne on erect peduncles and have sagittate shapes and marked sepal auricles. The lateral petals also often have clusters of clavate hairs. Where the two species come in contact, they grade together.

In the midwest *V. pratincola* may be confused with another glabrous violet, *V. missouriensis*. Differences are pointed out in the discussion of *V. missouriensis*.

24. ***Viola sagittata*** Ait., Hort. Kew. 3: 287. 1789.

The differences between *V. sagittata* and its close relative, *V. fimbriatula*, are discussed under the latter species. Its hybridizations with *V. affinis*, producing plants known as *V. emarginata*, are discussed under *V. affinis*.





*Viola sagittata* is a widespread stemless blue violet in central and eastern United States and is quite variable in size and pubescence. However the sagittate leaf form remains constant, except where modified by hybridization. It frequently hybridizes with other species in nature. Fernald (1950) lists ten known natural hybrids. Locally it may be considerably modified by natural hybridization, most frequently by crosses with *V. sororia* and *V. affinis*. I have analyzed two such cases of hybridization (Russell and Cooperrider, 1955; Russell and Risser, 1960).



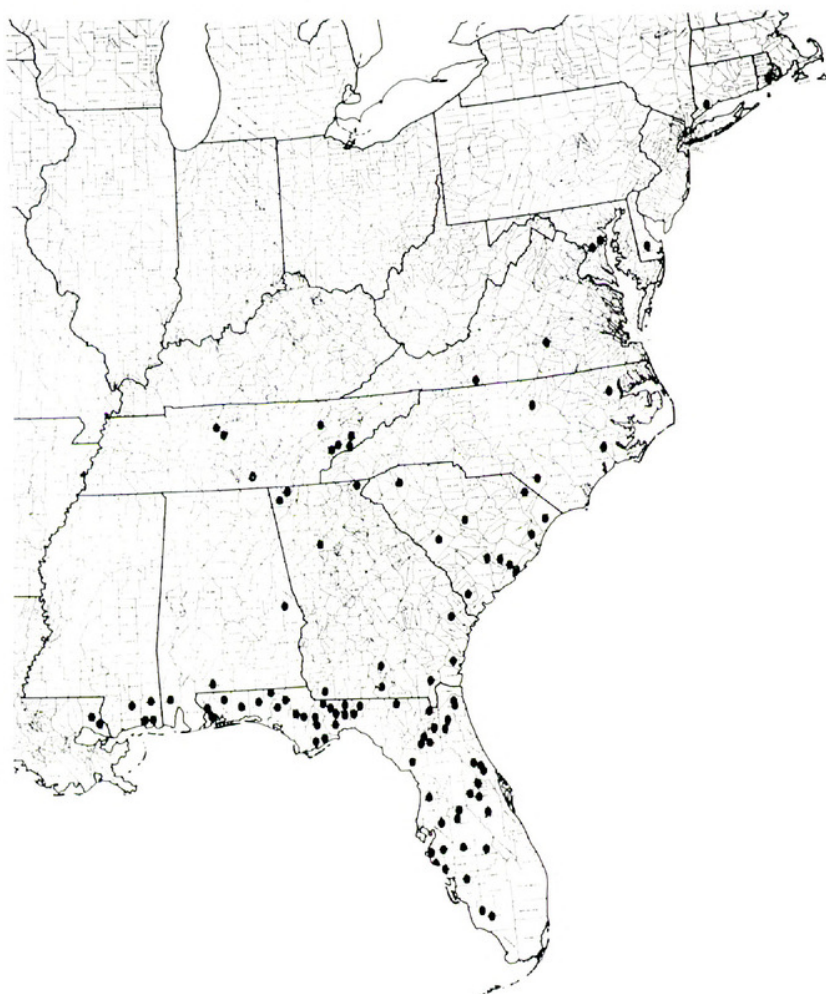


25. ***Viola septemloba*** LeConte, Ann. Lyceum N.Y. 2: 141. 1826.

This pretty little violet may produce one or two entire leaves in early spring, but the typical leaf form is pedate, with 7 to 9 slightly oblanceolate lobes. It grows in moist places in pine forests in the southeast. It rarely forms dense clones or mats; instead the plants occur singly, often widely separated from each other.

In the discussion of *Viola pedata*, its similarities to that species and to *V. brittoniana*, which replaces it in the northeast, were mentioned. I have seen some specimens with leaves almost identical to those of *V. pedata*. Both Gray and Brainerd (Brainerd, 1921) considered it to be most closely related to *V. palmata*. It does not appear so to me.

In the southeast, it is most easily confused with *V. esculenta*, and can sometimes be distinguished only with difficulty. I have found the shape of the leaf lobes the best feature. *V. esculenta* has broader, more obovate lobes, more similar to those of *V. triloba* var. *triloba*.

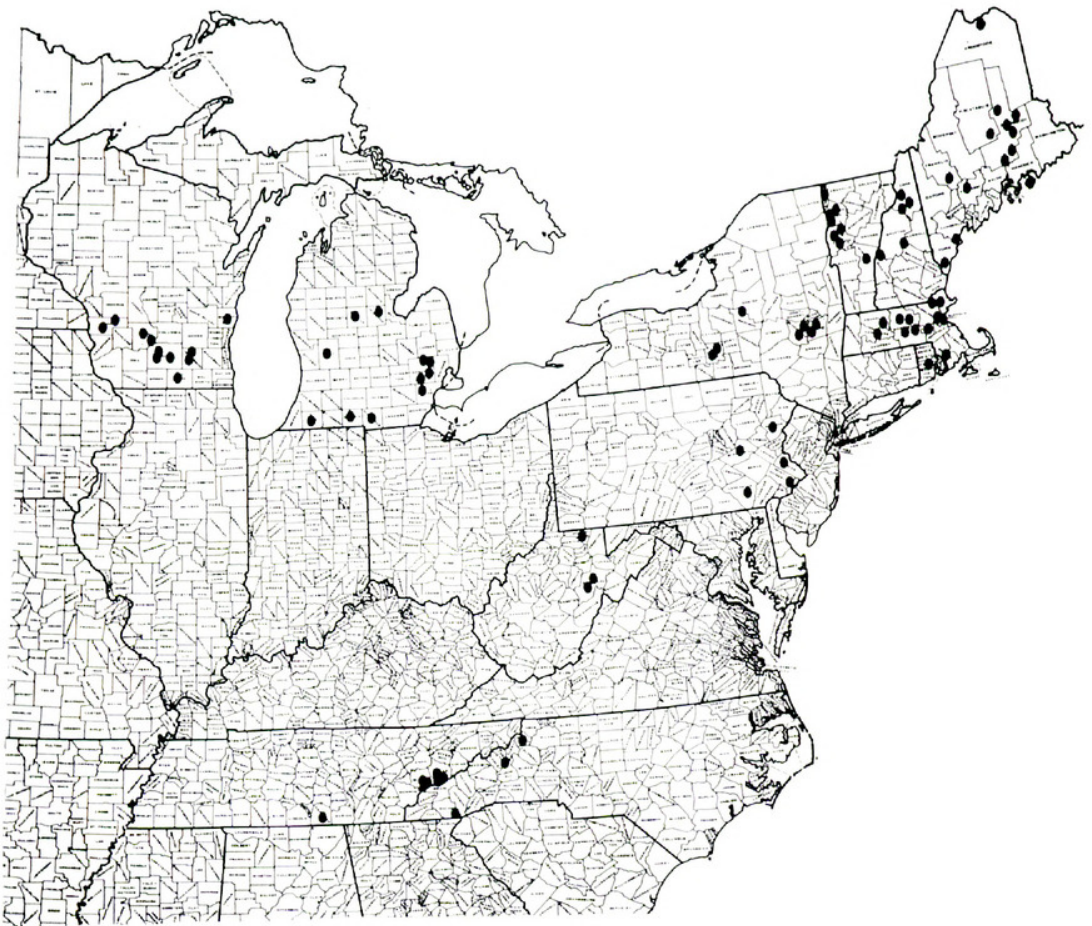




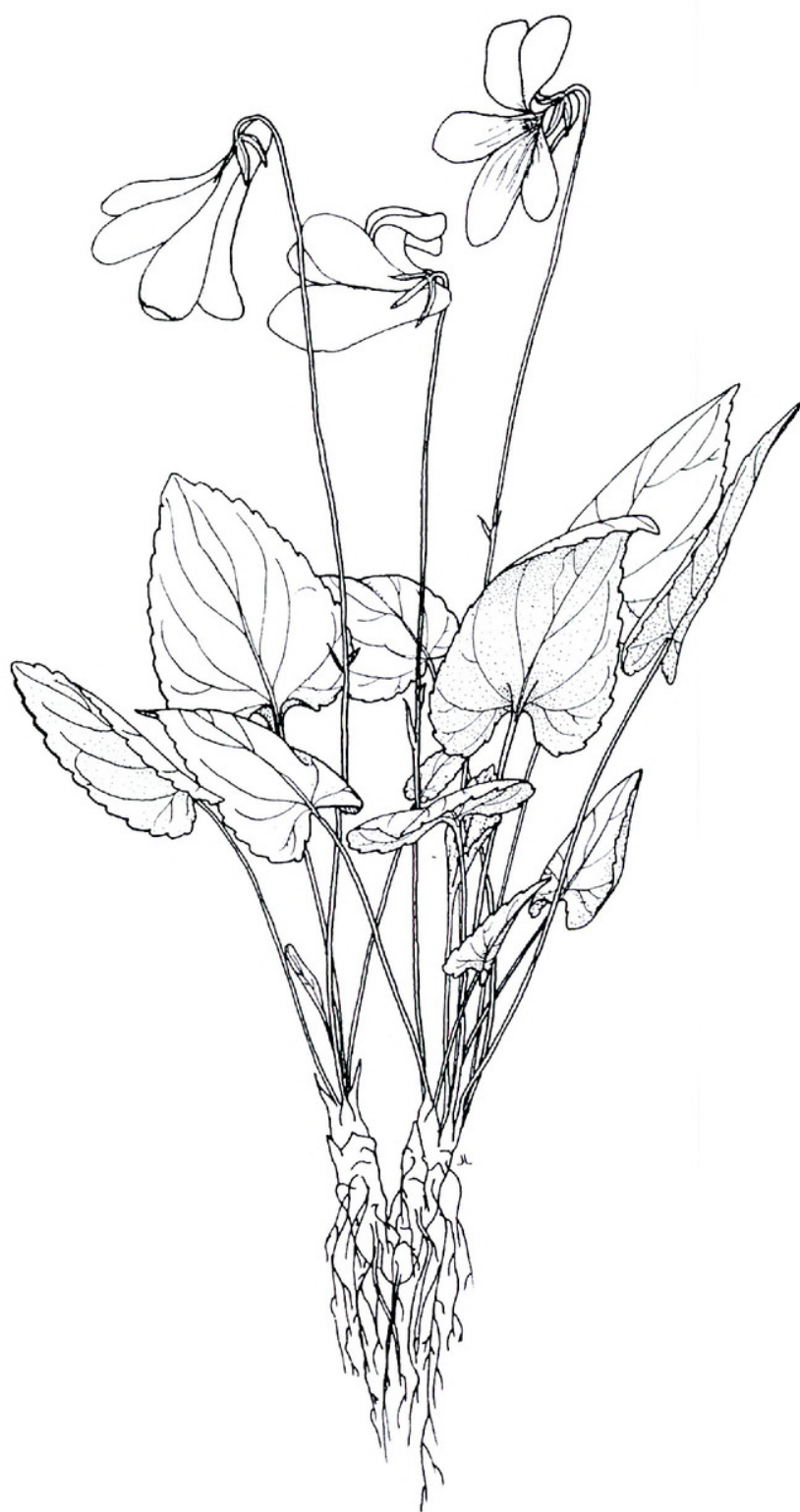
26. ***Viola septentrionalis*** Greene, Pittonia 3: 334. 1898.

*Viola septentrionalis* is locally abundant in parts of New England and in the southern Appalachians, where it may fill high elevation (about 5000') beech forests. In New England it is more abundant under conifers. In general aspect it most closely resembles *V. sororia*. It differs from *V. sororia* in its larger, thinner, more heart-shaped leaves, in the nature of its pubescence which is sparser and concentrated on the lower lamina surface, in having a distinct fringe of hairs around the lamina margin, in the sepals being closely ciliated around their total margins, and in having smaller, globose capsules borne on thin peduncles.

*Viola septentrionalis* is known to hybridize with several other stemless blue violets, especially *V. fimbriatula* and *V. cucullata* (see discussion under *V. cucullata*).

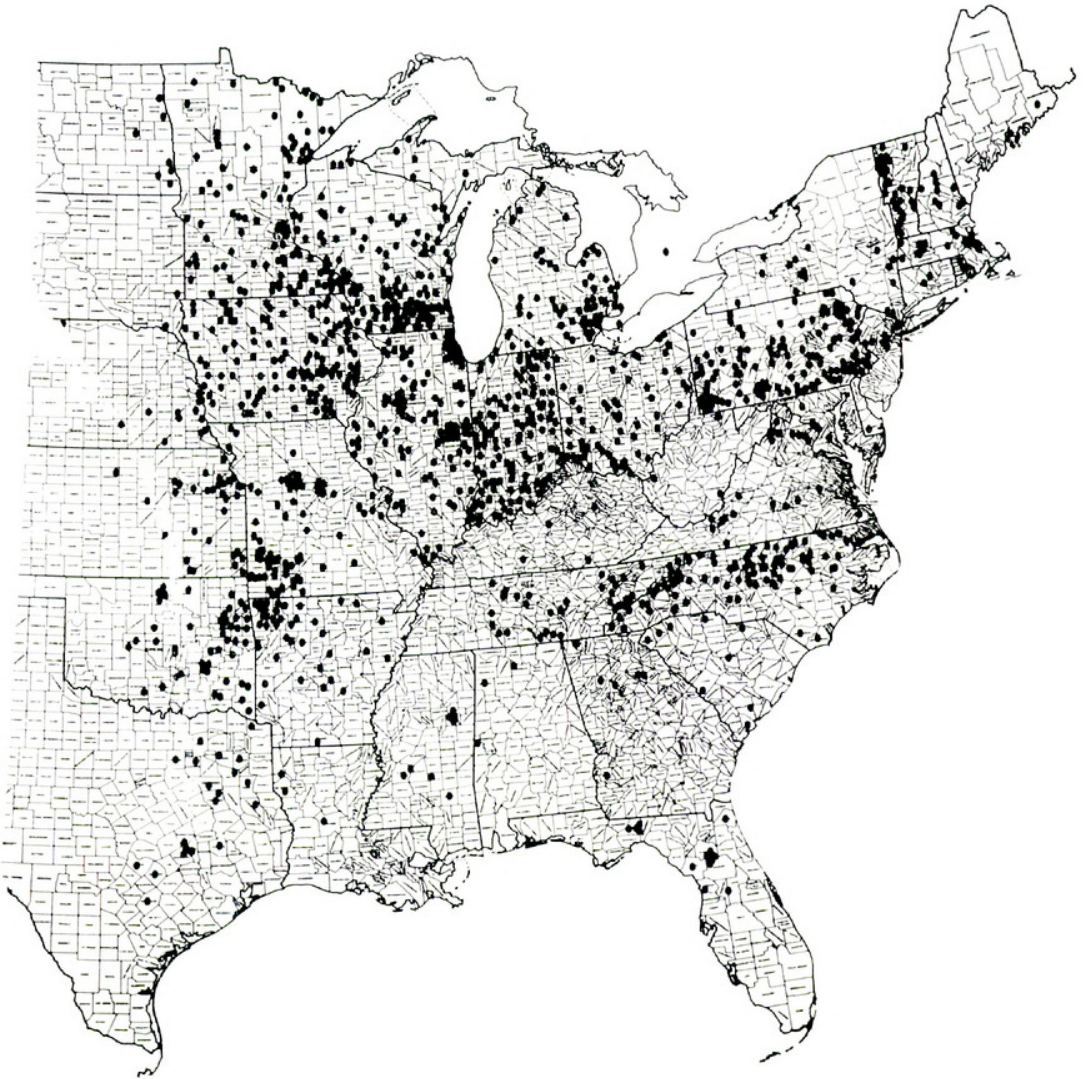






27. ***Viola sororia*** Willd., Enum. Hort. Berol. 1: 72. 1809.

This is the commonest species of violet in the eastern United States, being most abundant in the upper and central midwest, where it occurs in almost every deciduous woodland, as well as in every town and city as a common weed. It is the most variable of all the stemless blue violets in such features as petal color, size, and lamina pubescence. Petal color, normally dark blue or purple, may be bright red, light blue, pure white, or the peculiar gray-blue of the so-called "Confederate violet," a sometimes cultivated variant (*V. priceana* Pollard). In size it varies from the tiny plants sometimes found in oak woodlands in Minnesota to huge plants in Missouri and warmer climates. In pubescence it is supposed to be densely villous. This villous condition is most frequently found in the upper midwest; elsewhere it varies to an almost completely glabrous condition. As explained in the discussion of *V. pratincola*, most plants formerly assigned to *V. papilionacea* prove to be glabrate forms of *V. sororia*.







As might be expected, *V. sororia* can be difficult to characterize at times. Its more distinguishing characteristics are: the presence of some degree of pubescence, always uniformly distributed over the petiole and lamina surfaces; flowers usually dark purple, on peduncles shorter than the petioles; cleistogamous fruits large, ovoid, purplish, and borne on short, prostrate peduncles; lateral and spur petals heavily bearded with cylindrical hairs.

One might wonder about the source of this considerable variation and also about the vigor that makes this species the most successful of all violets in disturbed areas. On close examination of specimens of *V. sororia* from over its range, something remarkable is seen. In New England specimens tend to resemble *V. cucullata* and especially *V. affinis*; in Minnesota they have characteristics of *V. sagittata* and *pedatifida*; in the lower midwest they resemble *V. missouriensis*; and in the southeast, *V. floridana*. In local situations it may resemble still other stemless blue violets. Indeed Fernald (1950) cites its name as meaning "sisterly, resembling other species." Fernald reported it as hybridizing with 14 other stemless blue violet. Indeed it seems to hybridize with any stemless blue violet with which it comes in contact. A reasonable, though hard to test, presumption is that it has profited by these hybridizations and has a relatively very large gene pool. Because of this (presumed) introgression, it has been able to spread outward from its original home in dry, midwestern oak forests, into the territories of other violets, where it is becoming increasingly important.

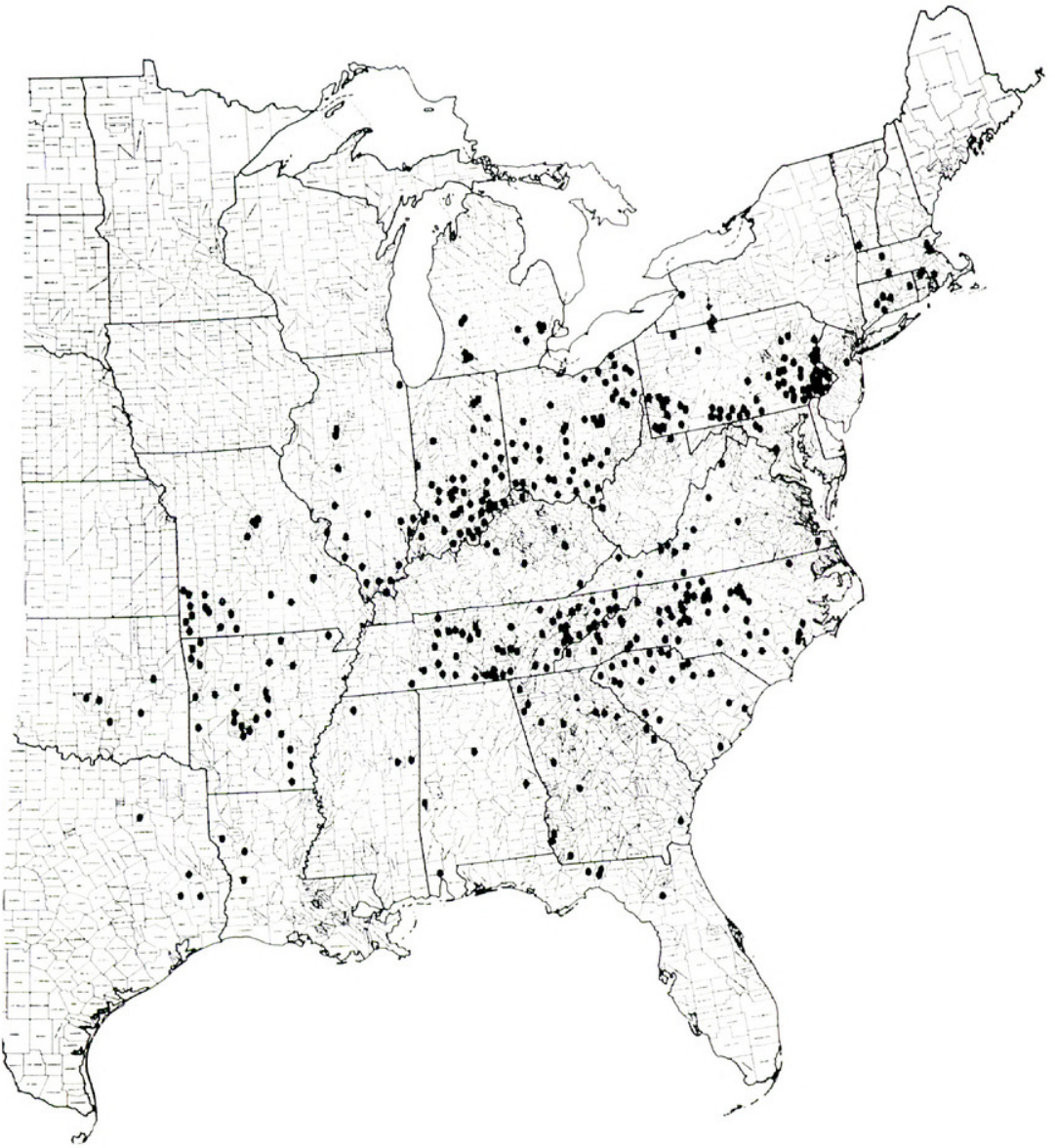
It is most similar to *V. triloba* var. *triloba*, with which it frequently occurs and intergrades. About the only discernible difference between the two species is in the lobing or non-lobing of the leaves. However, in spite of their apparent morphological intergradation, they were found to have distinctly different flowering periods in another study (Russell, 1960), indicating important physiological differences and supporting the maintenance of them as separate species.

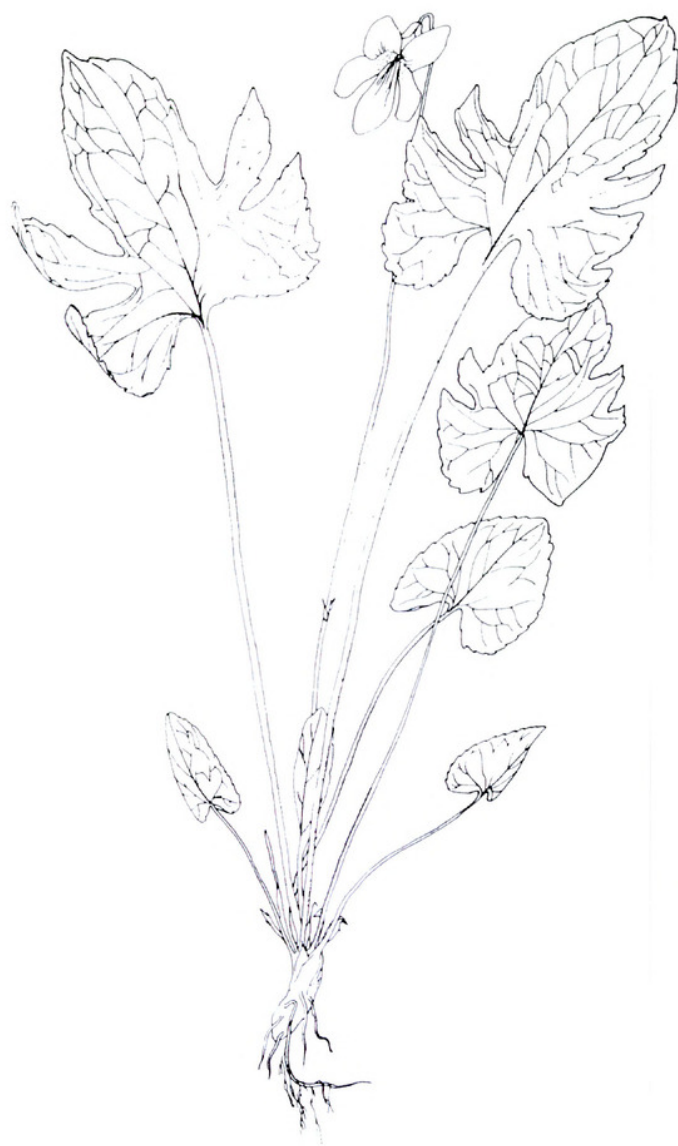


28. *Viola triloba* Schwein., Amer. J. Sci. 5: 57. 1822.

28a. *Viola triloba* var. *triloba*.

This violet, which closely resembles *V. sororia* except in the lobing of its leaves, occurs occasionally in dry woods throughout its range, which is extensive. As remarked in the discussion of *V. sororia*, it intergrades with that species. In addition, Fernald (1950) cites natural hybrids with eleven other species of stemless blue violets. These, however, are not frequent, and *V. triloba* does not appear greatly affected by introgression, as is almost certainly the case with *V. sororia*.



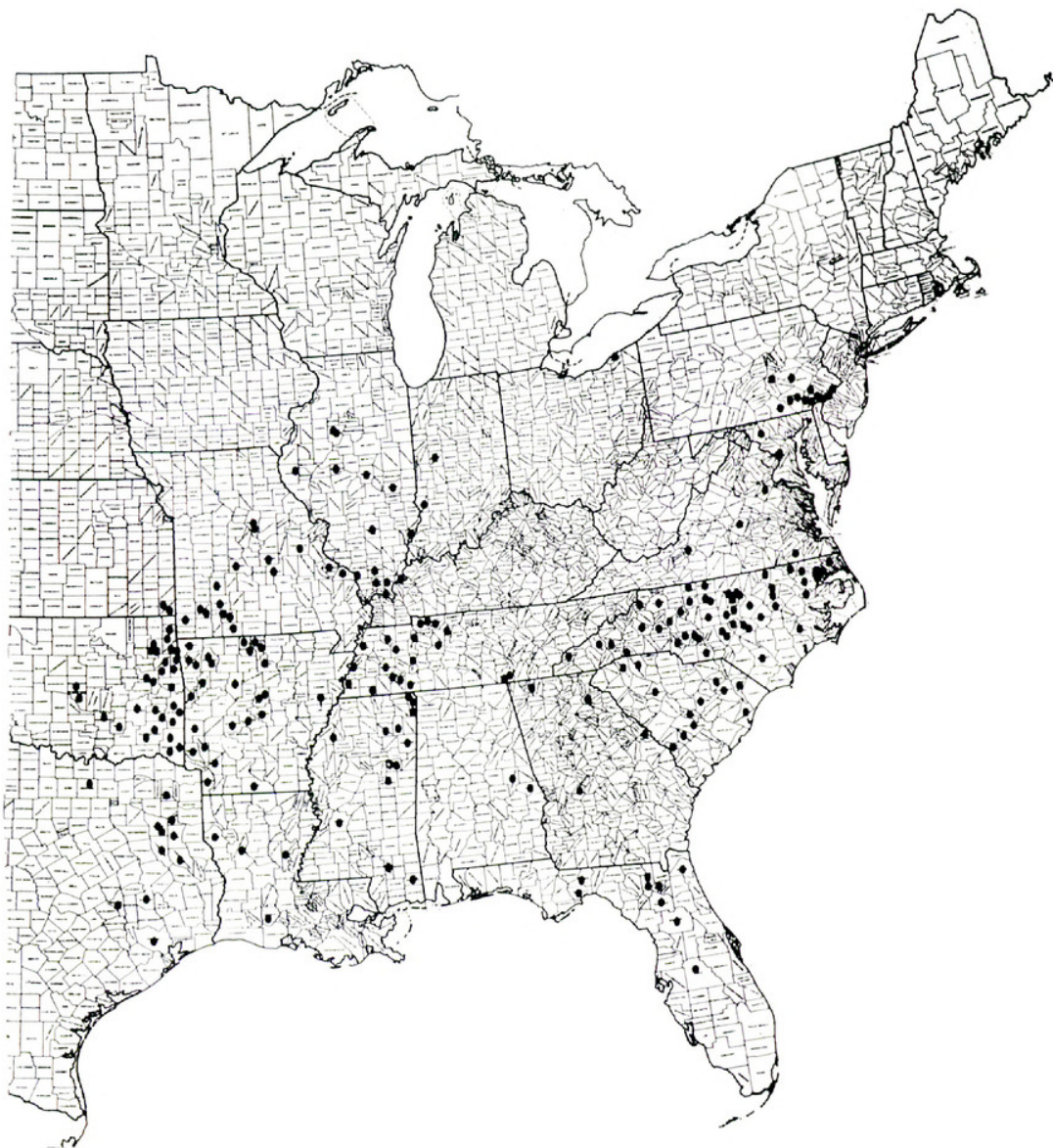




28b. ***Viola triloba*** var. ***dilatata*** (Ell.) Brainerd, Bull. Torr. Bot. Club 37: 586—588, pl. 36. 1910.

This variety of *V. triloba* is characterized by leaves with 5-7 very deep, sometimes almost linear, lobes. Although specimens intermediate between the two varieties are sometimes seen, I have never found populations of both together in the same forest. Though their ranges overlap broadly, *V. triloba triloba* is more characteristic of the Appalachians, and *V. triloba dilatata* occurs at and beyond the fringes of the range of *V. triloba triloba* most abundantly.

Physiologically the two varieties seem to be distinct as indicated by a study of their flowering periods at different latitudes (Russell, 1960).

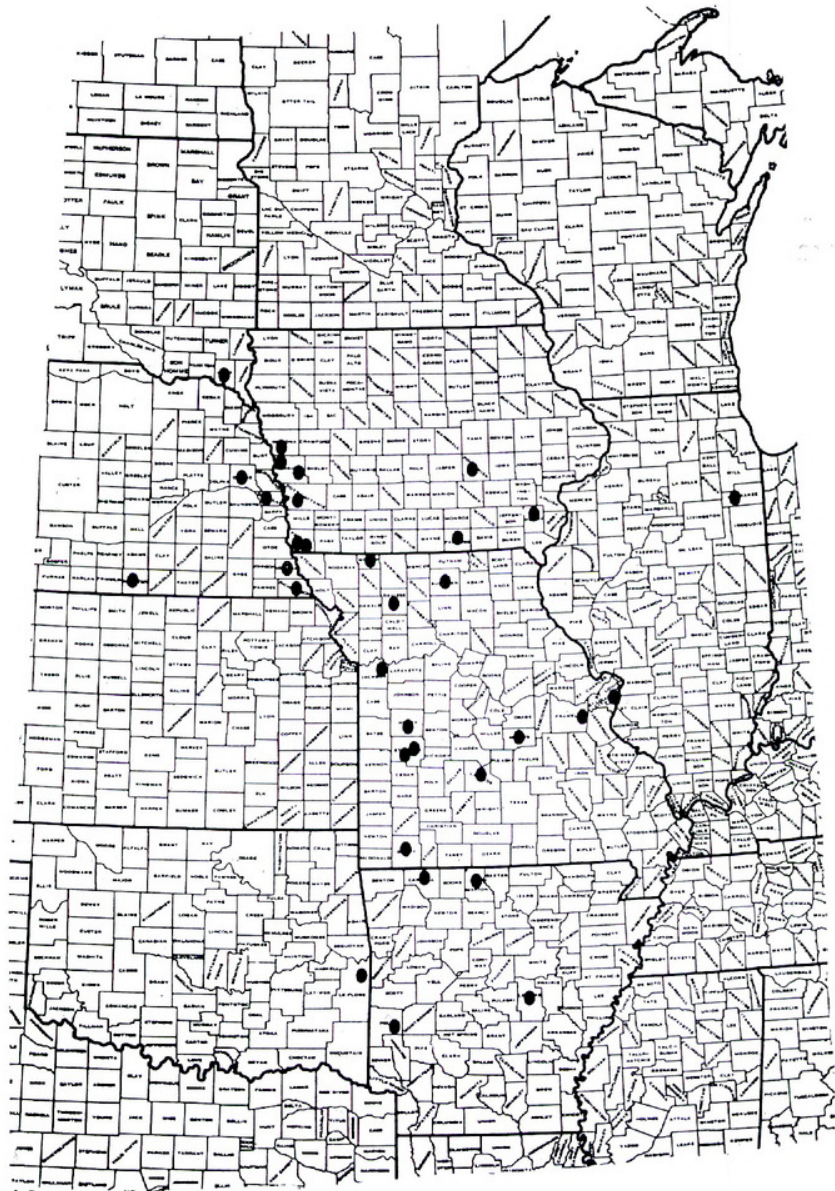






29. **Viola viarum** Pollard in Britton, Man. p. 635. 1901.

This strange little violet puzzled me for several years. At first I thought it may have been a hybrid. Many specimens so labeled proved to be *V. sagittata* hybrids, but others did not. Then one day in my front yard in Grinnell, Iowa, I discovered its nature. I had many spontaneously occurring plants of *V. missouriensis* and with them I found a few plants of *V. viarum*. There were also intermediates between the two. Subsequent observations have convinced me that *V. viarum* is a cut-leaved "species" of the *V. affinis*-*V. missouriensis* complex. It is found sporadically and may be, indeed, an occasional simple genetic form, instead of a species. I have observed many specimens of *V. missouriensis* with shallow basal incisions in the summer leaves. These are simply deepened in *V. viarum*. It, like *V. missouriensis*, is found on river banks or in floodplain forests.



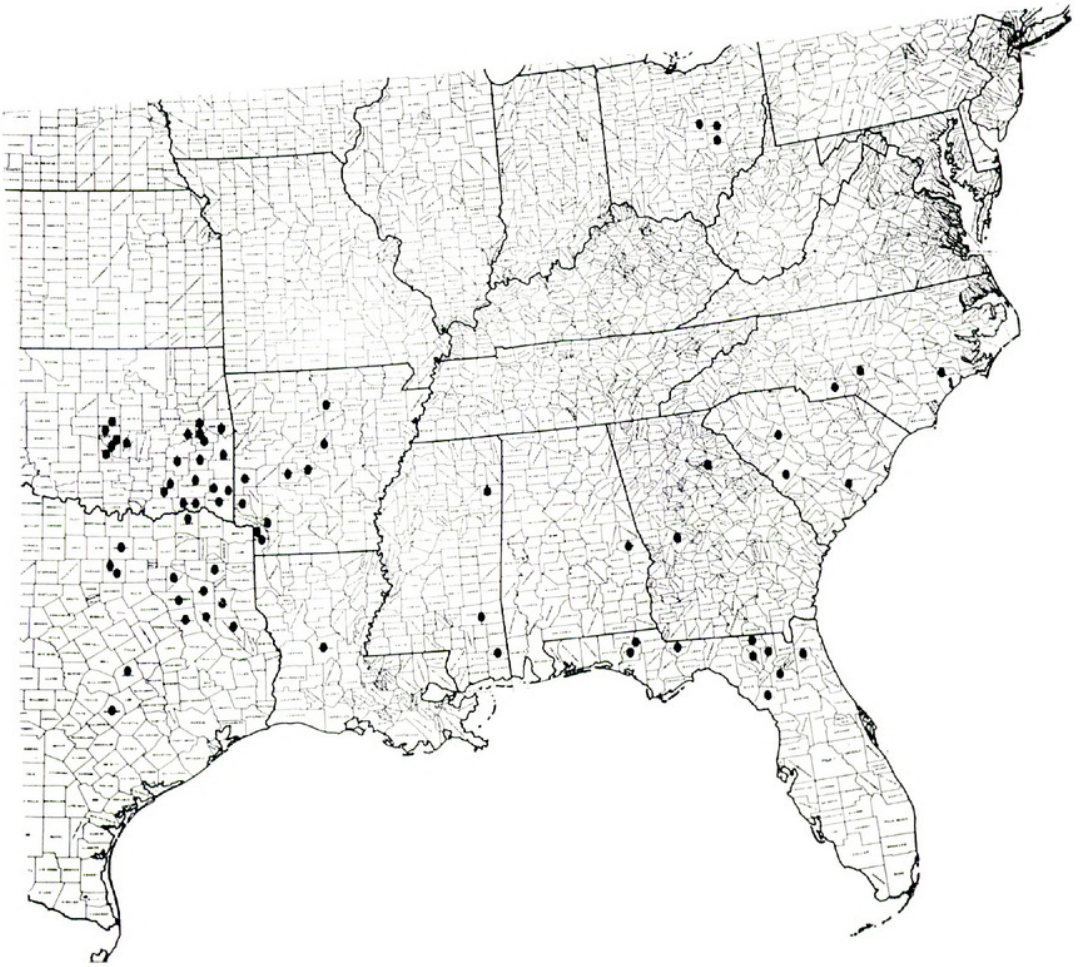


30. *Viola villosa* Walt., Fl. Car. p. 219. 1788.

This small, inconspicuous violet is found occasionally in moderately rich southern deciduous forests, in relatively sandy areas. Sometimes it grows with *V. lovelliana* (in the west) or *V. walteri* (in the east). It somewhat suggests a miniature *V. sororia* in superficial aspect, but is quite distinct from that species, resembling it mainly in its dense pubescence. I do not see any strong resemblance between *V. villosa* and any of the other stemless blue violets, nor have I seen evidences of hybridization with other species in the field. Fernald (1950) reported no natural hybrids.

My only suggestion for a possible relative is *V. sororia*, though if the two had a common ancestor, they have diverged considerably since their separation.

The nomenclatural history of this species was reviewed by Brainerd (1921), who clarified its confusion with both *V. sororia* and *V. hirsutula*.





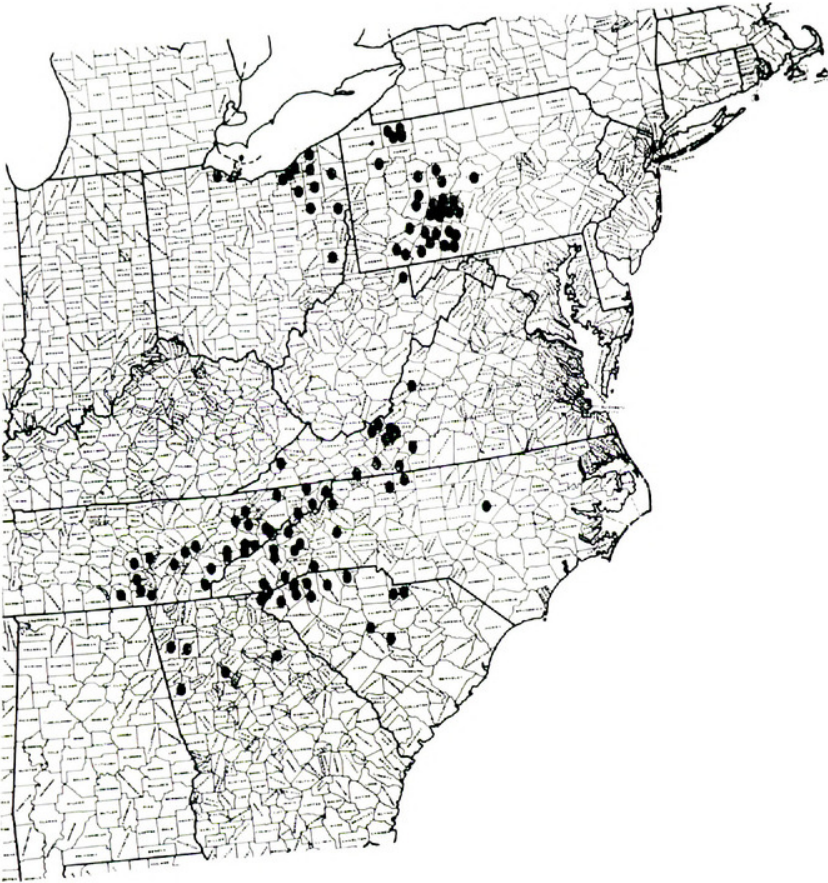


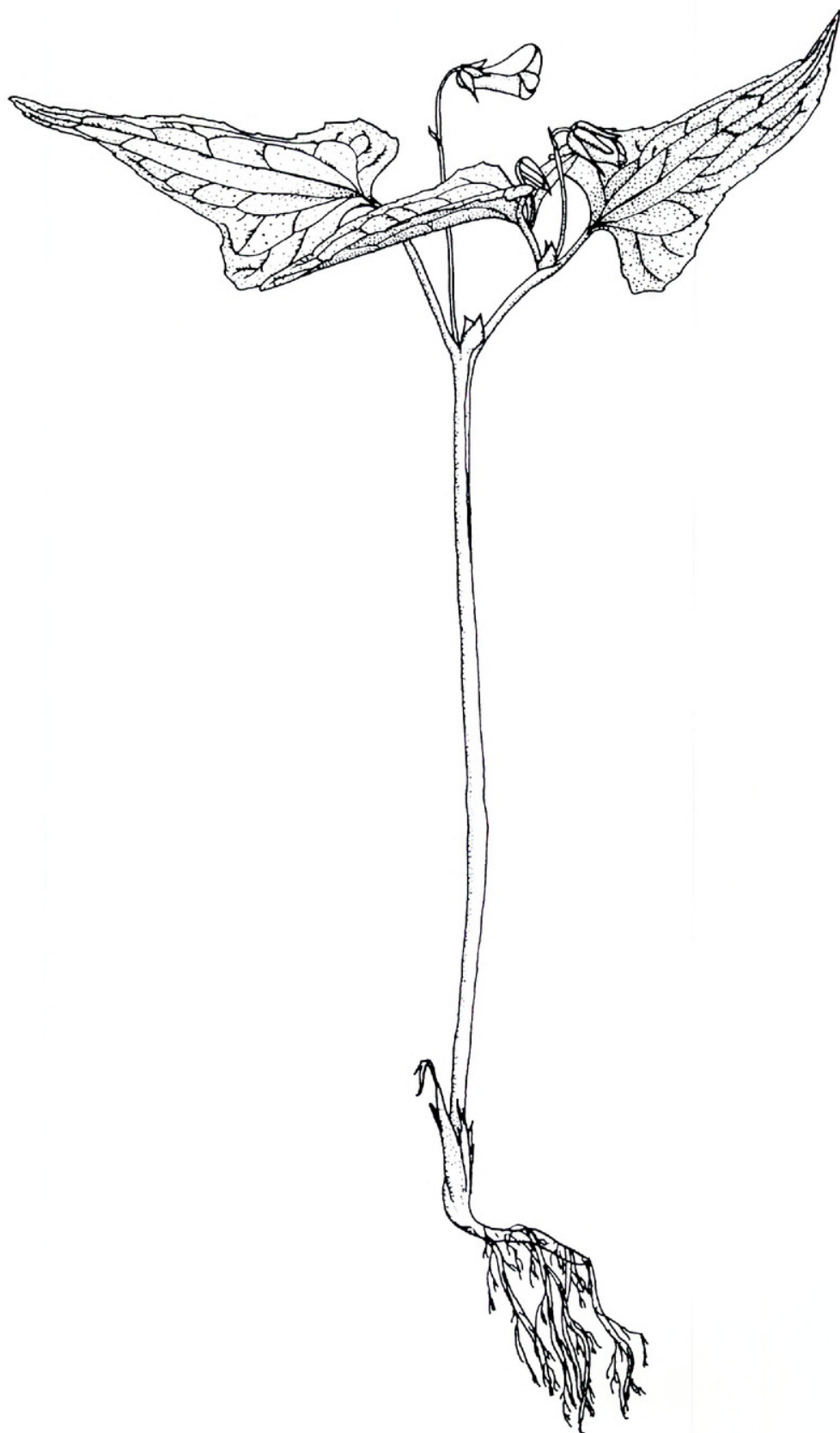
## GROUP III. STEMMED YELLOW VIOLETS.

31. *Viola hastata* Michx., Fl. Bor.-Am. 2: 149. 1803.

*Viola hastata* is a distinctive and beautiful violet, hardly to be mistaken for any other. Its elongate, triangular, green or purplish stem and root leaves are conspicuous in the dark, rich deciduous forests where it usually grows. Often the whitish, fragile rootstocks produce only single root leaves.

*Viola hastata* is related to the other stemmed yellow violets (*V. pubescens* var. *pubescens*, *V. pubescens* var. *eriocarpa*, *V. tripartita*, and *V. glabella*) by its growth form, petal color, and chromosome number ( $2n=12$ ). I have seen no instances of its hybridizing with them; it rarely occurs with them, being found in much richer forests.

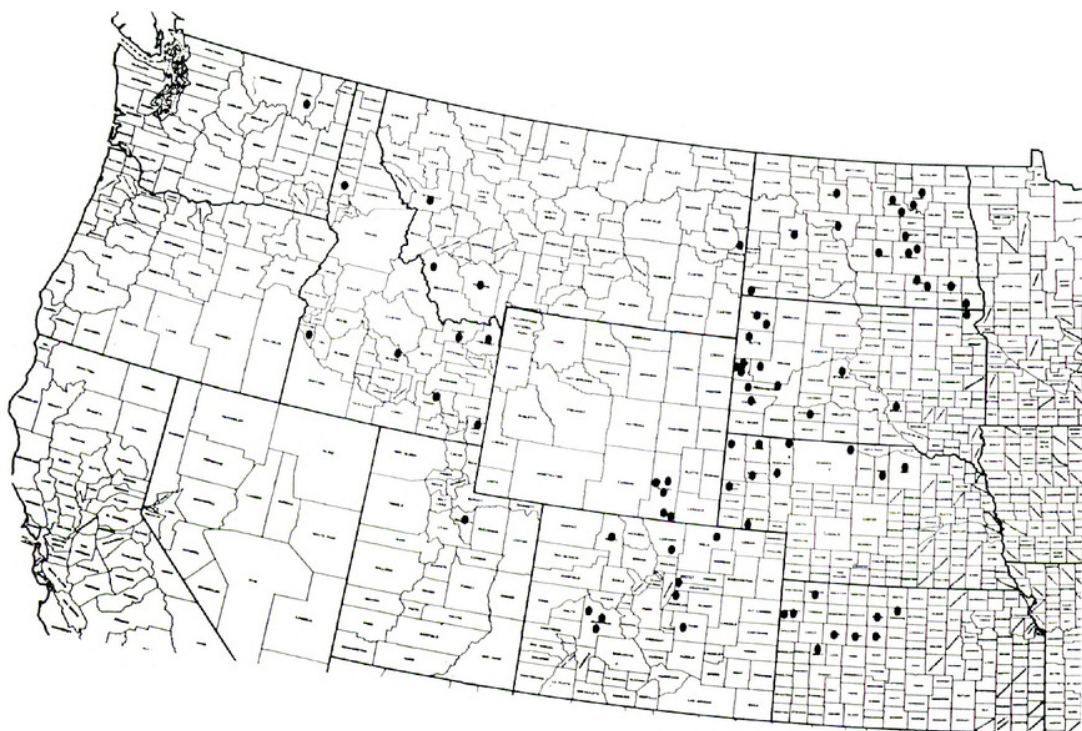






32. ***Viola nuttallii*** Pursh, Fl. Am. Sept. 1: 174. 1813 ("1814").

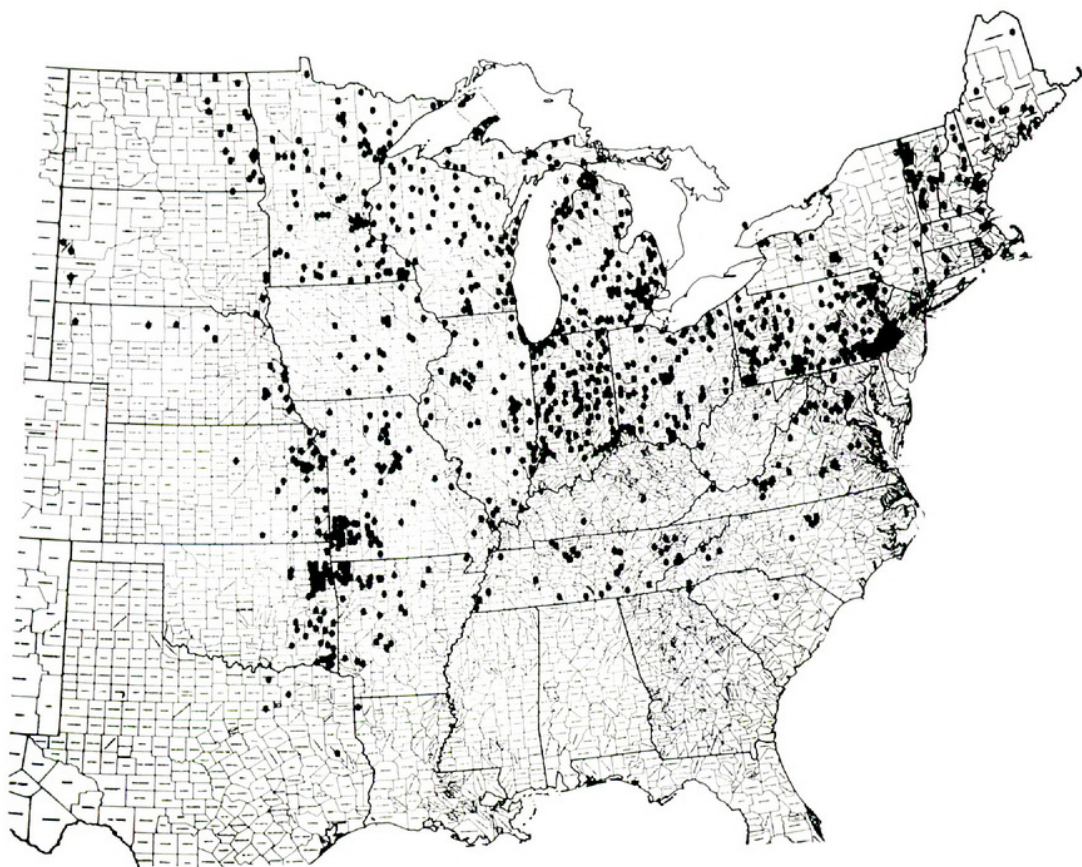
*Viola nuttallii* is essentially a western violet, occurring in central United States in the prairies and plains. It is quite different from other central and eastern violets, but is closely related to such western violets as *V. praemorsa* Dougl., *V. purpurea* Kellogg, and *V. chrysantha* Hooker. There is considerable variation in plant size and leaf form, and some taxonomists have divided it into additional species, namely *V. linguae-folia* Nutt. and *V. vallicola* Nelson. I have been unable to distinguish these in the field. An extensive population analysis in the central Rockies by Miss Millicent Kalil (ms.) also did not separate these additional forms.



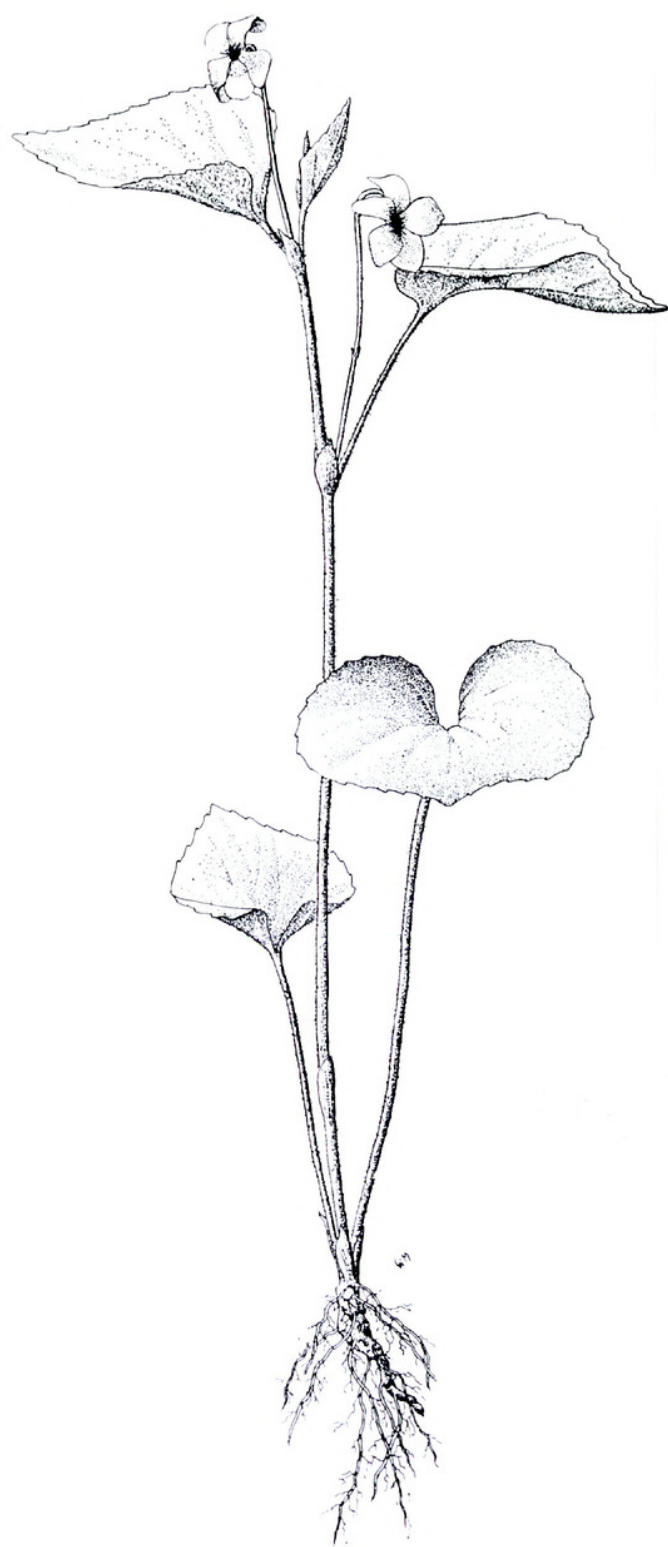


33. *Viola pubescens* Ait., Hort. Kew. 3: 290. 1789.

33a. *Viola pubescens* var. *pubescens*. The morphological nature and nomenclatural status of this violet are discussed under the next variety.







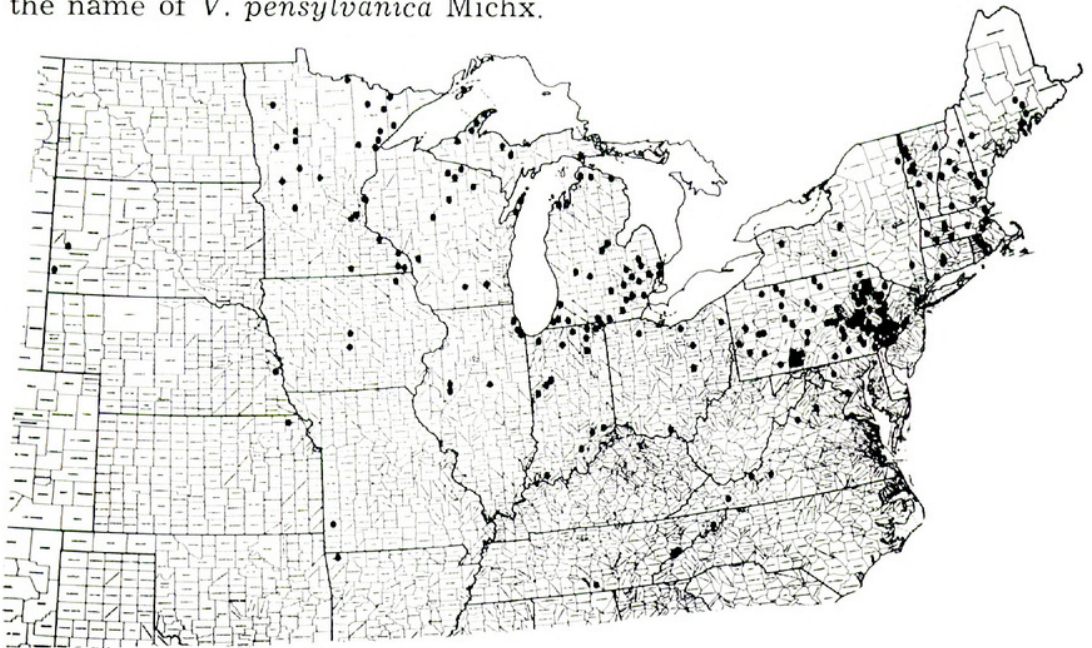
33b. *Viola pubescens* var. *eriocarpa* (Schwein.) Russell, comb. nov. *V. eriocarpa* Schwein., Amer. J. Sci. 5: 75. 1822.

The two varieties of *Viola pubescens* (as treated here) have long been considered separate, though sympatric, species by taxonomists. However such students of the violets as Ezra Brainerd (1921) have noted their intergradation in nature and remarked upon the difficulty of distinguishing them. After studying several thousand specimens, including many population samples, I believe that only a single species exists and that the two forms represent morphological and ecological extremes, most separate in the eastern part of their ranges.

Brainerd listed a number of differences between the extreme forms, and my observations support them. *Viola pubescens* var. *pubescens* usually has only a single flowering stem, one or two root-leaves, is densely hairy with long hairs, has 30 to 45 coarse teeth on the stem leaves, large broad stipules, and grows erect and tall (up to a foot or more) in shaded, dry forests on sandy soil. *Viola pubescens* var. *eriocarpa* extremes have several flowering stems, five or more root leaves, are finely pubescent to glabrate, have 25-30 teeth on stem leaves, smaller, narrower stipules, and grow spreading and partially prostrate (often six inches or less tall) in moist, open meadows.

The nearest relative (morphologically) of these two varieties seems to be *Viola glabella* Nutt. of the Black Hills (where it is indistinguishable from *V. pubescens* var. *eriocarpa*) and the western mountains. Further study may well indicate that it is also best considered a variety of *V. pubescens*. In the Appalachian Mountains, two other members of the group of stemmed yellow violets are *V. hastata* and *V. tripartita*. See the discussions of them for remarks upon their affinities.

For many years recently *V. pubescens* var. *eriocarpa* has gone under the name of *V. pensylvanica* Michx.



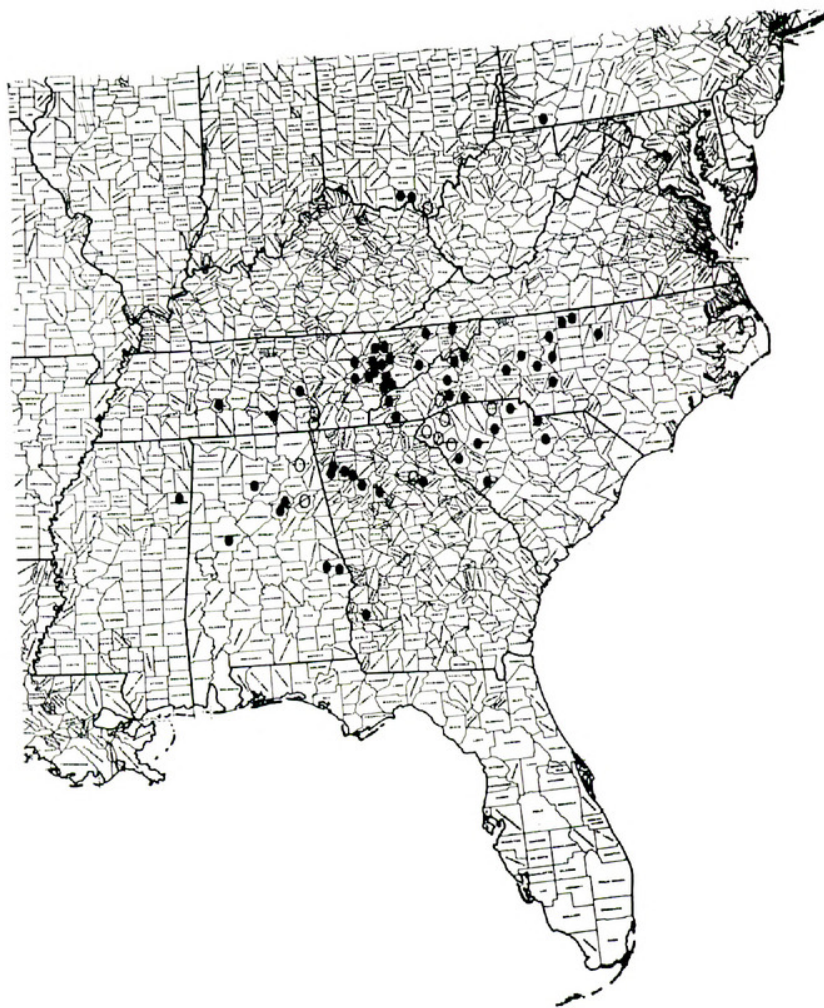




34. ***Viola tripartita*** Ell., Sketch Bot. S.C. & Ga. 1: 302. 1818.

This species, often very similar to *V. pubescens* var. *pubescens* in general form, is noted for the dimorphism of its few leaves, which vary from entire to deeply three-lobed. The name above was originally applied to the form with parted leaves and the names *V. tripartita* var. *glaberrima* (Ging.) Harper and *V. tripartita* forma *glaberrima* (DC.) Fern. to plants with uncut leaves. I do not recognize the two forms as nomenclaturally distinct here. They are sympatric and frequently grow together and intergrade. I have mapped them separately, using open circles for the *glaberrima* form.

*Viola tripartita* is infrequently encountered in southern Appalachian forests. I have found it in relatively dry ravines in older, mixed deciduous woods, often under oaks and hickories. Though very similar in general aspect to *V. pubescens* var. *pubescens*, its cut or triangular leaves usually render it quite distinct. I know of no instance of its hybridizing with other violets in nature.



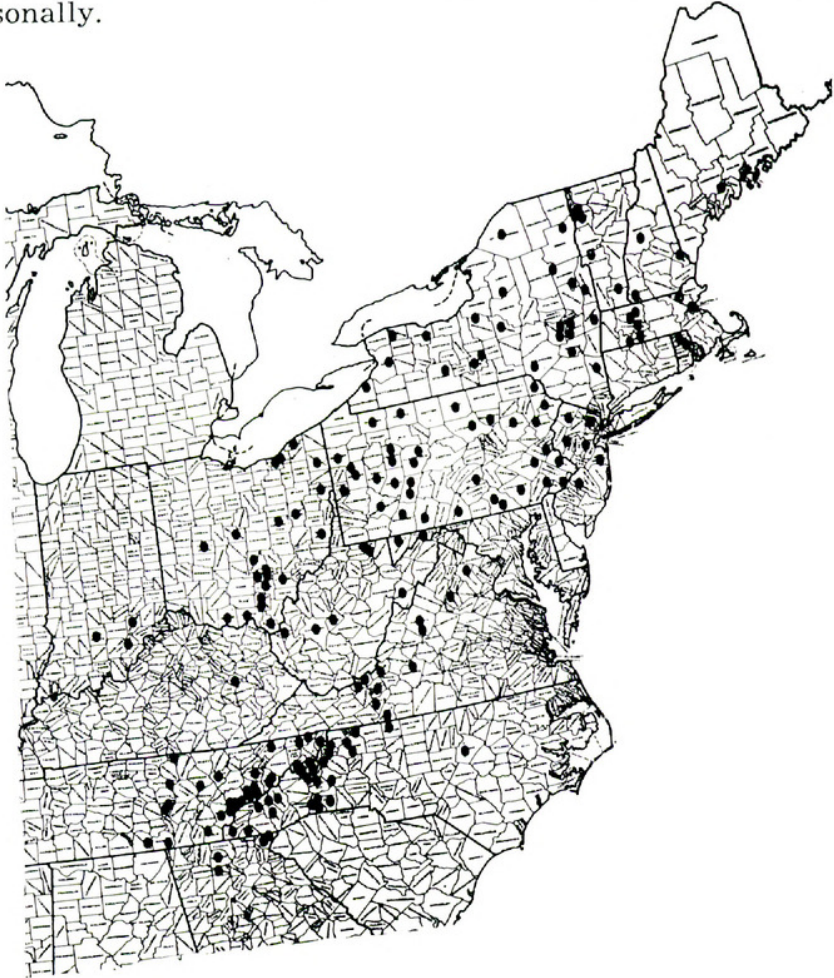




## GROUP IV. STEMLESS WHITE VIOLETS.

35. *Viola blanda* Willd., Hort. Berol. t. 24. 1816.

*Viola blanda*, the "sweet white violet," is primarily an Appalachian species, found westward as far as southern Indiana. It has been confused with *V. incognita*, *V. macloskeyi* subsp. *pallens*, and *V. macloskeyi* subsp. *macloskeyi* and thus has occasionally been erroneously reported as occurring in such distant states as Minnesota and California. It may be distinguished from the other cordate- or reniform-leaved stemless white violets by the following combination of characteristics. *Viola blanda* has leaves which are always pubescent with short, stiff, white hairs on the upper surfaces of the basal lobes; the shape of the leaf is distinctly cordate or heart-like and very symmetrical. The basal lobes are short and frequently overlap, a good characteristic to use on summer, fruiting specimens. The apex of the leaf is acute or sometimes slightly acuminate. The petals of the open flowers are beardless. Usually, long leafy vegetative stolons are produced; sometimes these may be up to a foot in length. It occurs in moist, shaded, relatively undisturbed forests, most frequently under hemlock, though it may be found occasionally in rich beech-maple forests. It is said that the flowers of *V. blanda* have a faint, sweet odor, but I have been unable to detect this personally.





Morphological variation in *V. blanda* follows an interesting pattern. In the southern Appalachian Mountains of western North Carolina and eastern Tennessee, the plants are at one extreme of variation in many morphological characters, and gradually change from this outward in every direction, particularly to the north, also becoming more variable away from this "center" (Russell, 1956c).

Where *V. blanda* and *V. incognita*, a species very similar to it, grow together there is frequently morphological intergradation between them, and a rather strong case for hybridization and introgression may be made. I have published an analysis of one such case (Russell, 1954b) in western Pennsylvania and have observed other similar situations elsewhere, particularly in the Southern Appalachians. The chromosome number of the two species has been said to be the same ( $2n=48$ ) (Gershoy, 1934), and in the paper cited above I discussed the possibility of a close evolutionary and genetic relationship between them. *V. incognita* is principally found in glaciated territory and *V. blanda* in non-glaciated.

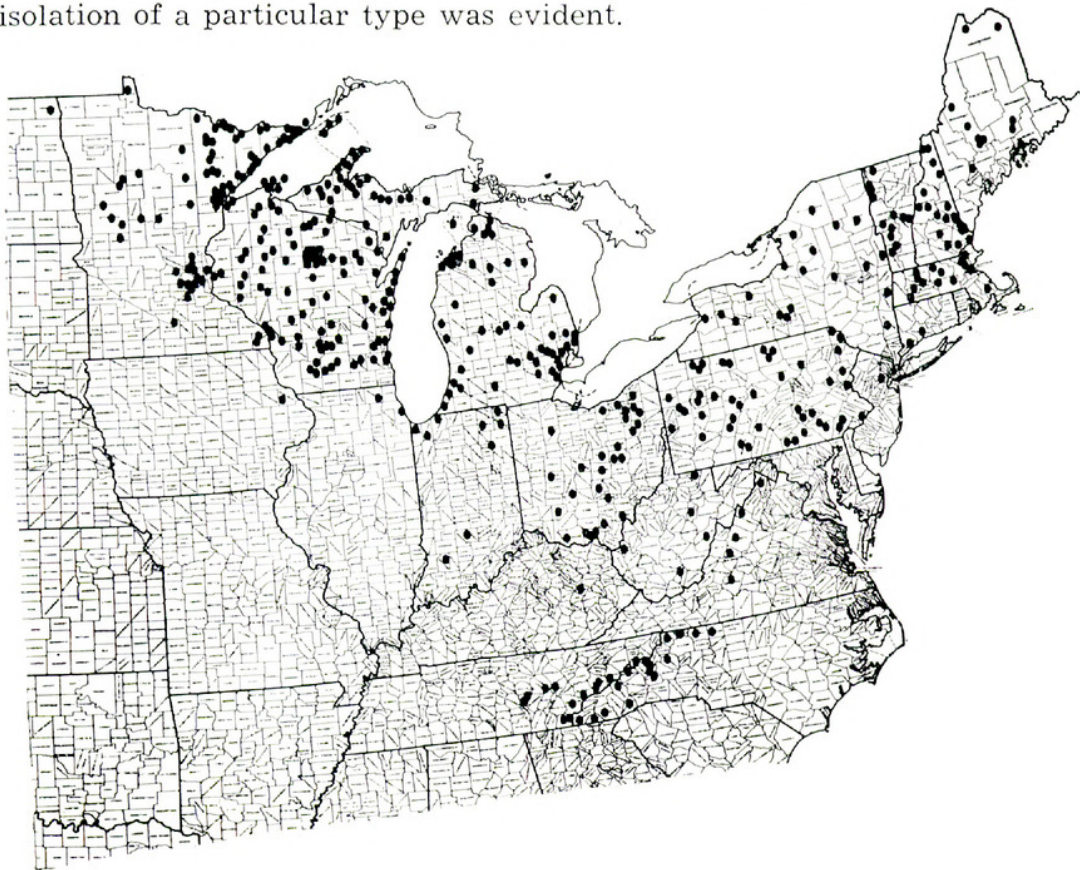


36. *Viola incognita* Brainerd, Rhodora 7: 248. 1905.

Brainerd (1921) reviewed the interesting and sometimes confusing history of the recognition of this common, tiny, white-flowered violet. It continues to be confused by taxonomists, particularly with *V. blanda* and *V. macloskeyi* subsp. *pallens*—as evidenced by the many errors in annotation I have come across in various herbaria. A typical plant of *V. incognita* has even recently been named as a new variety of *V. blanda*.

*Viola incognita* differs from *V. blanda* and the other stemless whites by the combination of the following characteristics: a marked beard on the inner faces of the lower pair of petals, broadly cordate leaves with large, diverging lobes, laminae always pubescent, vigorous vegetative stolons (not so leafy as those of *V. blanda*), cleistogamous fruits purple or purple-flecked on prostrate peduncles, and seeds 1.6-2.0 mm. long.

Morphological variation, though not obvious, is considerable, and shows (as in *V. blanda*) patterns centering in the Southern Appalachians (Russell, 1956c). Lamina pubescence varies bewilderingly. Brainerd and others recognized (nomenclaturally) two varieties, one with the pubescence on both surfaces of the lamina (var. *incognita*) and the other with the pubescence only on the upper surfaces (var. *forbesii*), as in *V. blanda*. An extensive geographical analysis of lamina pubescence types (Russell, 1954a) failed, however, to reveal the presence of two such entities; instead, virtually every conceivable pattern of distribution of lamina pubescence was found, and no geographical or ecological isolation of a particular type was evident.





As noted in the discussion of *V. blanda*, *V. incognita* apparently hybridizes occasionally with *V. blanda* and perhaps also with *V. macloskeyi* subsp. *pallens*. It is most similar to *V. blanda* and may have been derived from the same ancestral form.

*Viola incognita* occurs usually in rich deciduous forests as well as occasionally under pines and hemlock in mixed forests. Where the soil is rich and undisturbed the plants may spread rapidly by means of vegetative stolons and form large colonies. It is found extensively in southeastern Canada, extending as far northward as southern Labrador.

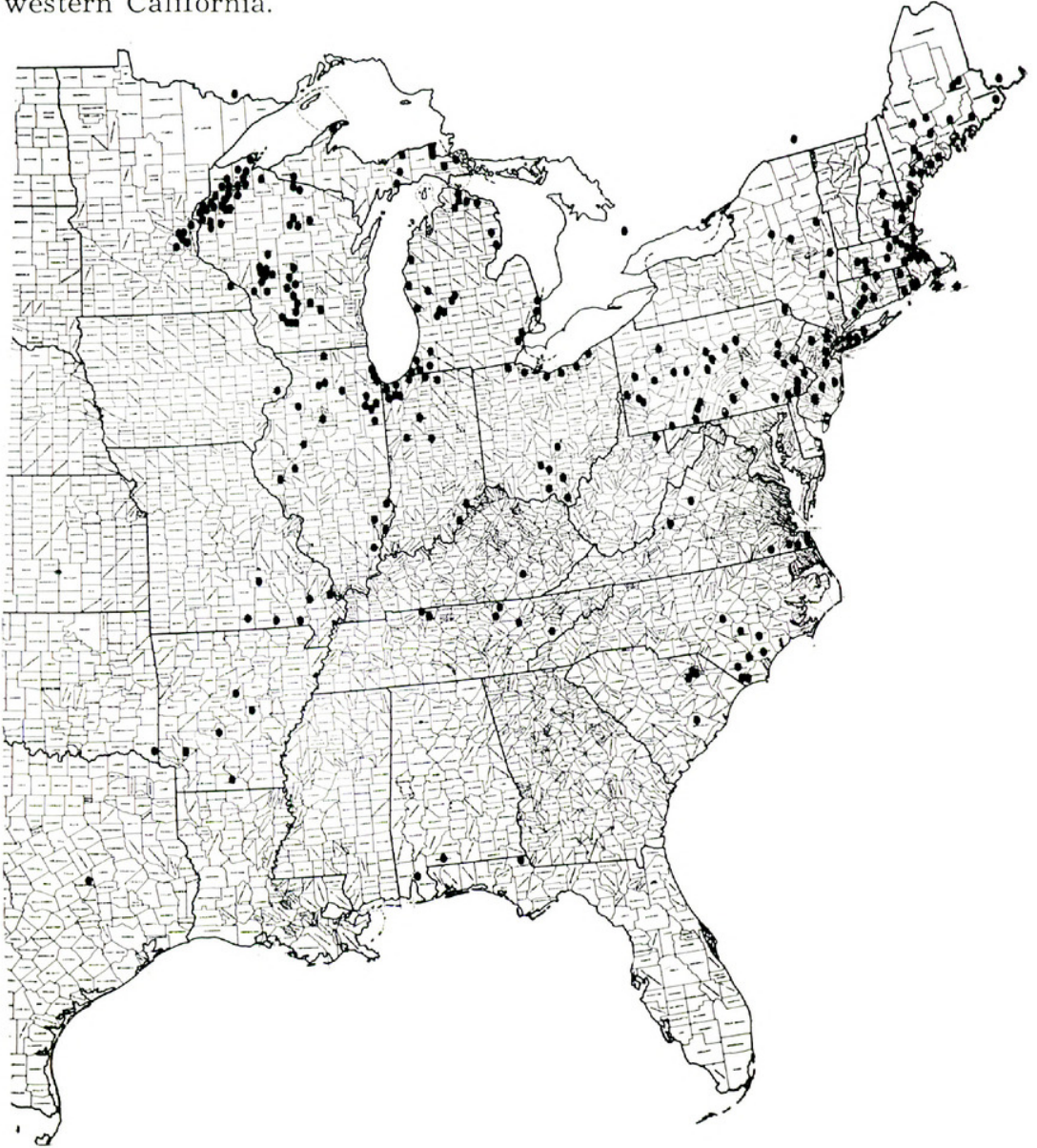




37. *Viola lanceolata* L., Sp. Pl. 134. 1753.

37a. *Viola lanceolata* subsp. *lanceolata*.

This is found in open, sunny, sandy areas, frequently beside streams and ponds. In the eastern part of its range it often occurs with *V. primulifolia*, with which it hybridizes and backcrosses freely. In the northern parts of its range it sometimes grows with *V. macloskeyi* subsp. *pallens* and produces a hybrid with that species which remarkably resembles *V. primulifolia* (see discussion of *V. macloskeyi* subsp. *pallens*). To the south *V. lanceolata* subsp. *lanceolata* gradually merges with *V. lanceolata* subsp. *vittata*, from which it differs primarily in leaf shape. In addition to its eastern range it has also been collected in cranberry bogs in western Washington. A third form, *V. lanceolata* subsp. *occidentalis* (Gray) Russell, is found in southwestern Oregon and northwestern California.



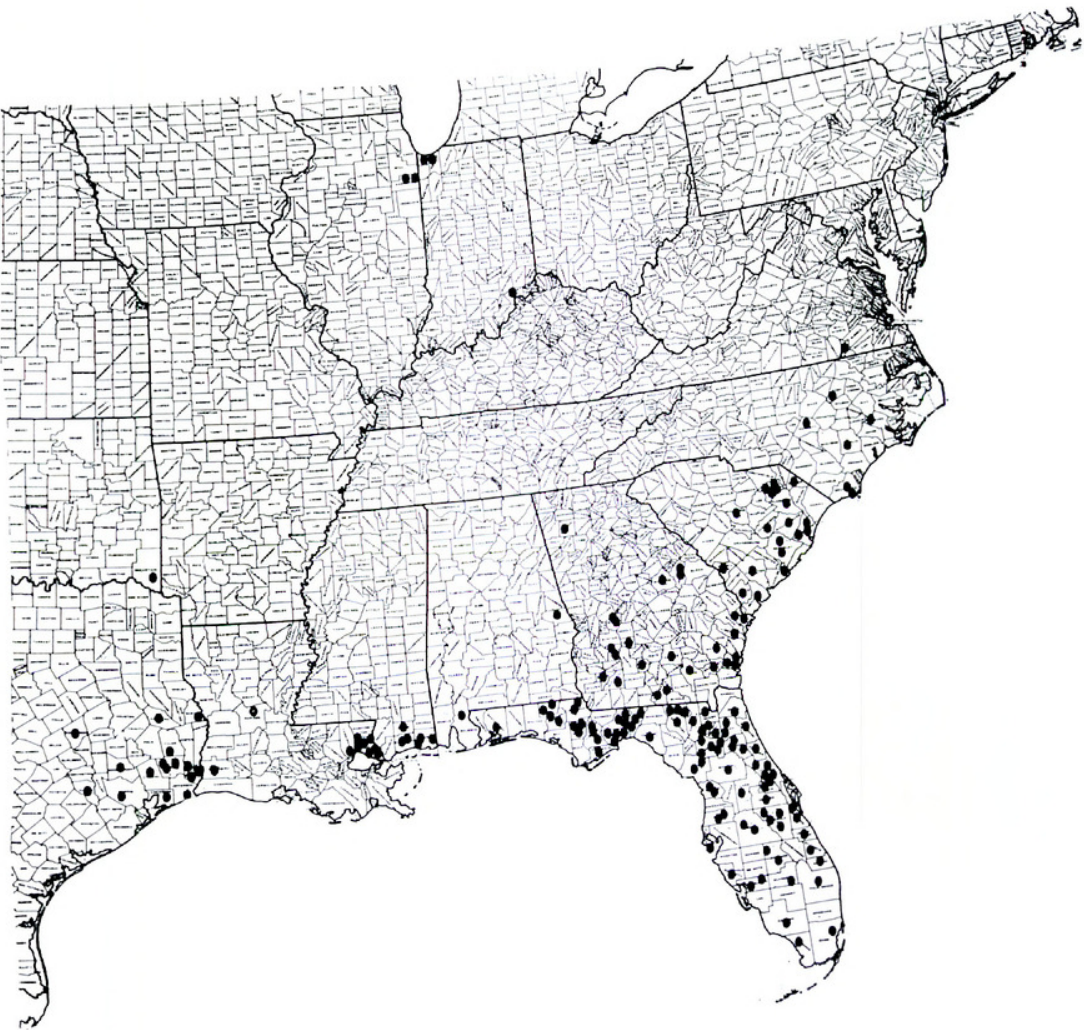


37b. **Viola lanceolata** subsp. **vittata** (Greene) Russell, Amer. Midl. Nat. 54: 484-485. 1955.

This distinctive violet occurs abundantly on the southeastern coastal plain in sandy soil in open ditches and beside streams. The mature summer leaves may be as much as a foot in length and up to fourteen times as long as broad. To the north it gradually merges with *V. lanceolata* subsp. *lanceolata*. It occasionally hybridizes with *V. primulifolia*.

On the preceding page, the specimen at the right is a spring plant of this subspecies.

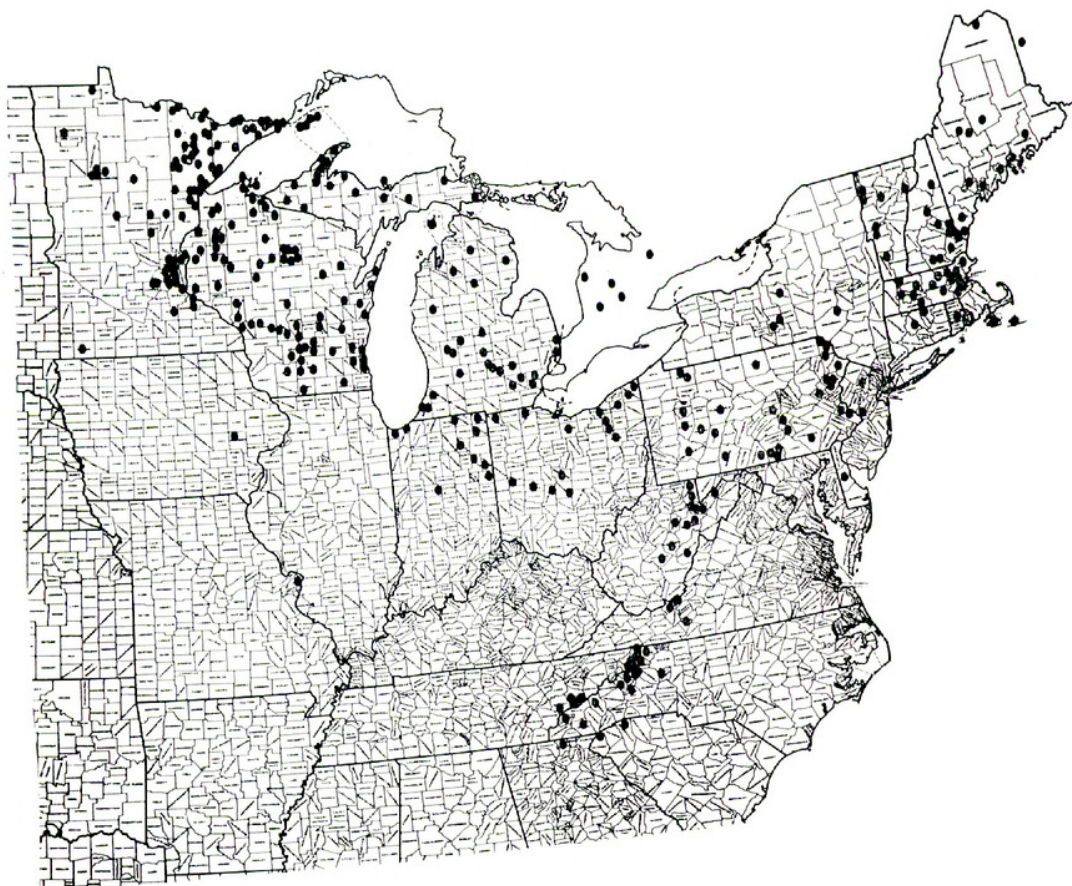




38. ***Viola macloskeyi* Lloyd subsp. *pallens* (Banks) M. S. Baker, Madrono 12: 60. 1953.**

*Viola macloskeyi* subsp. *pallens* has a divided range, not being found in the central prairie states of North Dakota, South Dakota, and Nebraska. In the western part of its range, it grades gradually into *V. macloskeyi* subsp. *macloskeyi*. Its variation patterns in the east indicate an Appalachian extreme of variation in most morphological characteristics with gradual clines outward from this. The peculiar western and eastern patterns were explained in a previous paper (Russell, 1956c) as probably being the result of two range separations in the past. The first, perhaps in the early Tertiary, resulted in the formation of the two subspecies; the second, probably in the Pleistocene, resulted in separating the two portions of *V. macloskeyi* subsp. *pallens*.

This tiny violet is found in very wet situations, either in the open or in partial shade. It frequently occurs with other stemless white violets, and may be distinguished from *V. incognita*, *V. renifolia*, and *V. blanda* by its completely glabrous leaf blades with pubescent petioles (usually). The flowers are the tiniest found in the stemless white violets.





*Viola macloskeyi* subsp. *pallens* has been demonstrated to hybridize with *V. lanceolata* subsp. *lanceolata* where they grow together, as occasionally happens in the upper midwest (Russell, 1954b). The  $F_1$  generation is usually very sterile and resembles *V. primulifolia* (No. 39), for which it is often mistaken. I have seen these hybrids from Minnesota, Wisconsin, Michigan, and New England. In New England *V. primulifolia* also occurs, and specimens must be examined carefully to determine whether or not they are the hybrids.

This violet has generally been known as *Viola pallens* (Banks) Brainard.

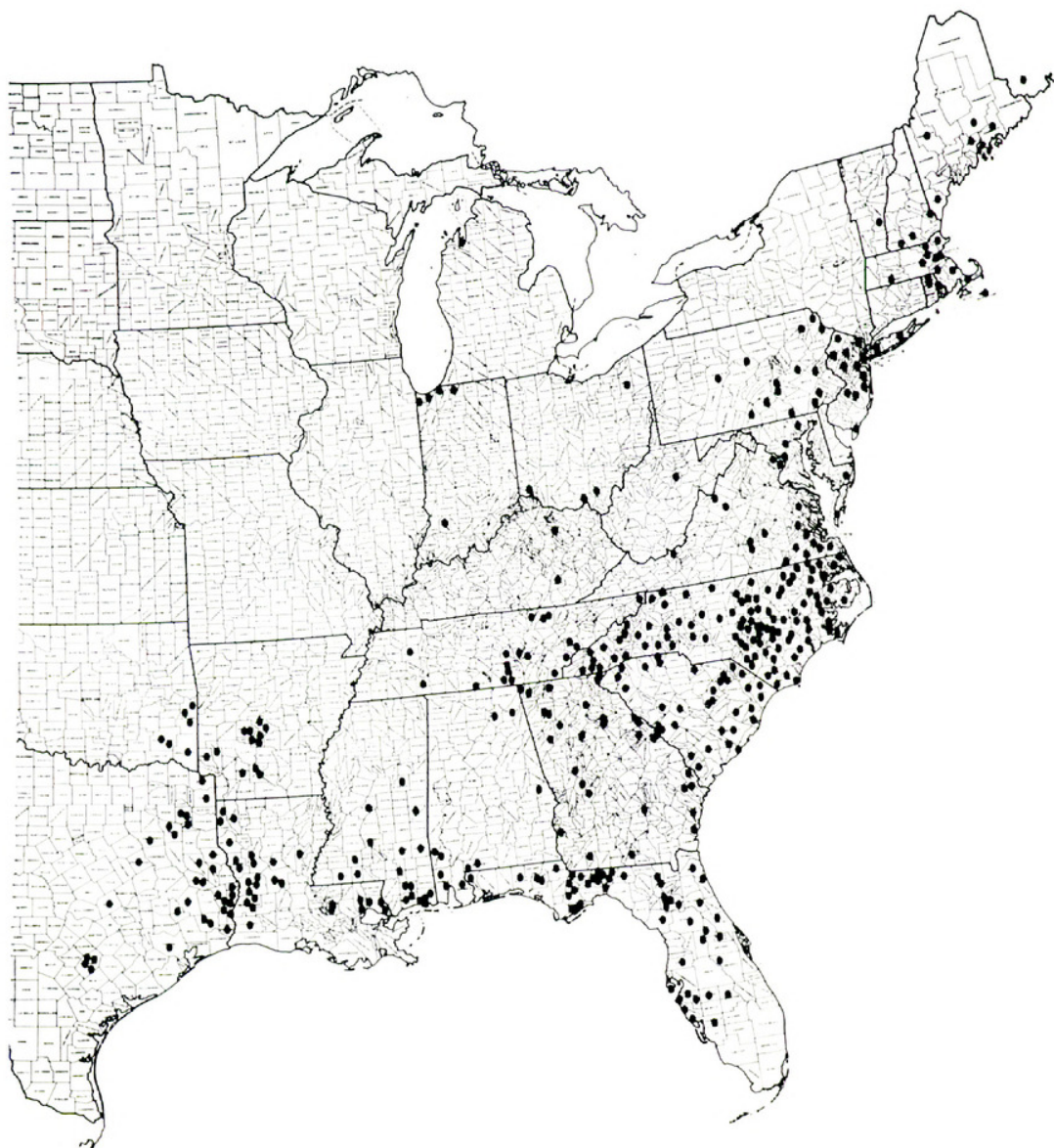




39. *Viola primulifolia* L., Sp. Pl. 934, 1753.

In a previous study (Russell, 1955b), two subspecies (*primulifolia* and *villosa*) were recognized, but subsequent observation of herbarium material and especially field populations in southeastern United States has convinced me that they are not distinct. There is a great deal of variation among plants of *V. primulifolia* in leaf shape and pubescence, but it follows no discernible geographical or ecological patterns (Russell, 1956c).

*Viola primulifolia* occasionally hybridizes with *V. lanceolata* and *V. macloskeyi* subsp. *pallens*. It occurs in moist open meadows and along the edges of streams, particularly in sandy soil.





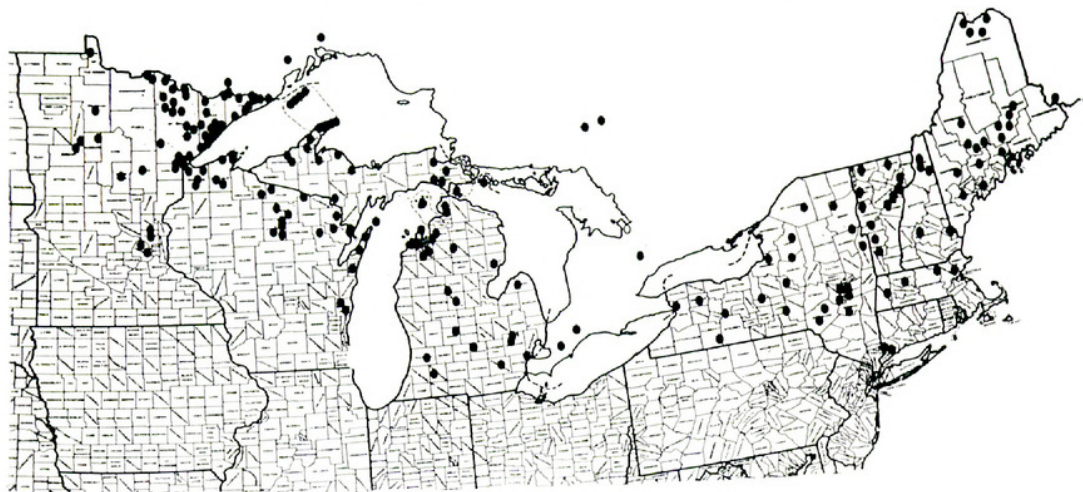


40. ***Viola renifolia*** Gray, Proc. Amer. Acad. 8: 288. 1870.

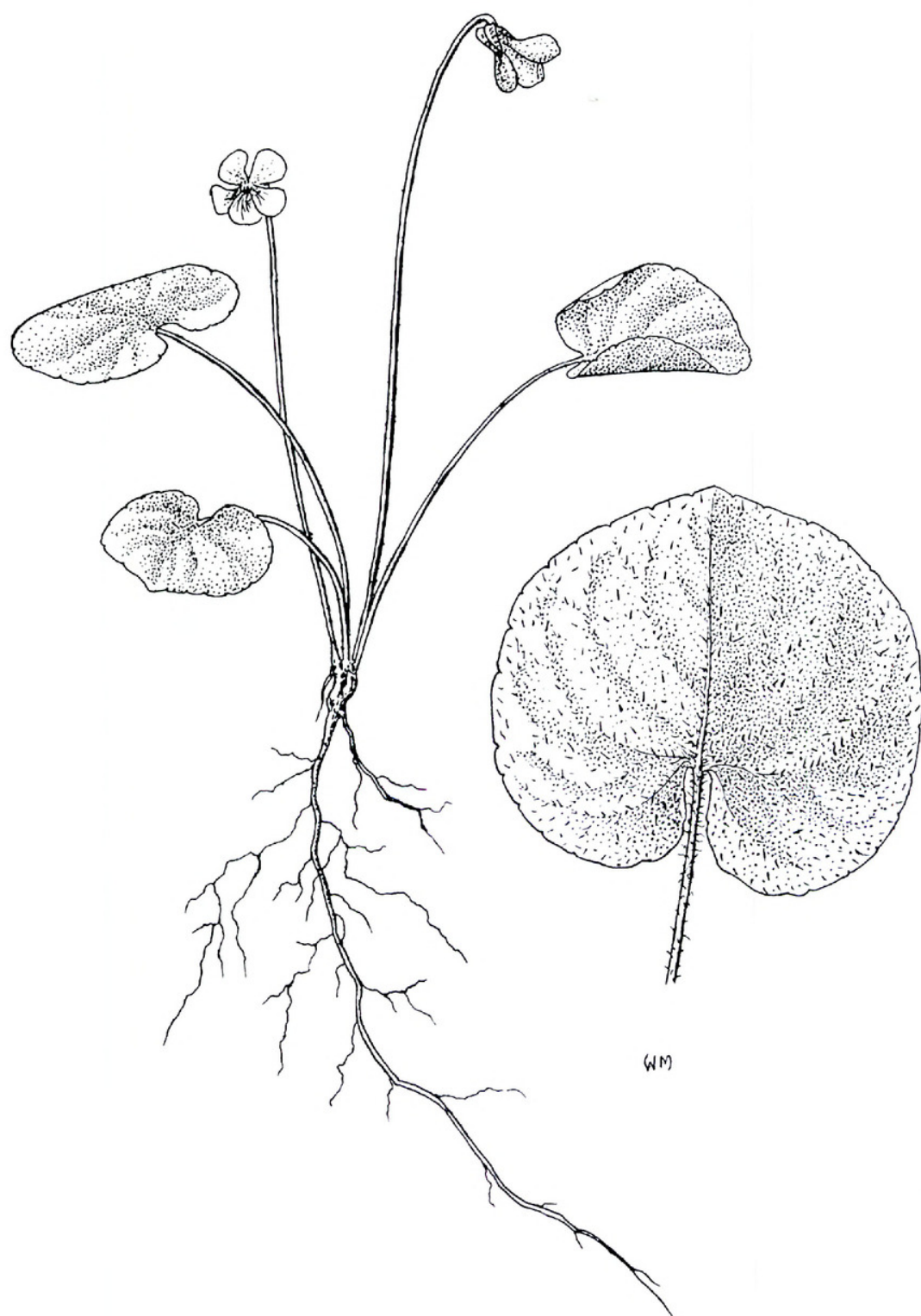
*Viola renifolia* is a widespread and relatively frequent violet in Canada, occurring from southern Labrador to northern British Columbia. In eastern and north central United States it is found entirely in glaciated territory, growing usually under evergreens, particularly spruces, firs, hemlocks, and white cedar. It may be looked for in rather moist, deeply shaded forests, where it occurs as scattered plants, rarely if ever in dense colonies. It has a short, rather thick, often vertical rootstock and never produces above-ground stolons, though rarely it may reproduce vegetatively by short, subterranean rhizome branches. Leaf form is distinctive, all but the first leaf or two produced each year being broadly reniform. Leaf pubescence varies greatly; three classes may be distinguished with difficulty: leaves completely glabrous, laminae pubescent on lower surface and glabrous on upper, and laminae heavily pubescent on both surfaces. However, in a regional analysis of pubescence types (Russell, 1954a), I concluded that these types were not sufficiently distinct morphologically or geographically to merit nomenclatural recognition.

In an analysis of variation of several morphological characteristics throughout its range (Russell, 1956c), I found *V. renifolia* to be one of the two or three least variable of the North American violets. Specimens from various parts of its range are virtually indistinguishable. In addition, the only instance I have seen where there was a suspicion of hybridization was in a white cedar bog forest north of Minneapolis, Minnesota (Russell, 1954b). Here *V. renifolia* grew with *V. incognita* and *V. macloskeyi* subsp. *pallens*. Specimens of all three species had unusual characteristics that may have arisen as a result of hybridizations and resultant introgression.

*Viola renifolia* has been said to have a diploid chromosome number of 24 (Gershoy, 1934). Some other distinctive characteristics are the absence of beards on the petals, and the summer production of purple or purple-flecked cleistogamous capsules on short, deflexed peduncles.







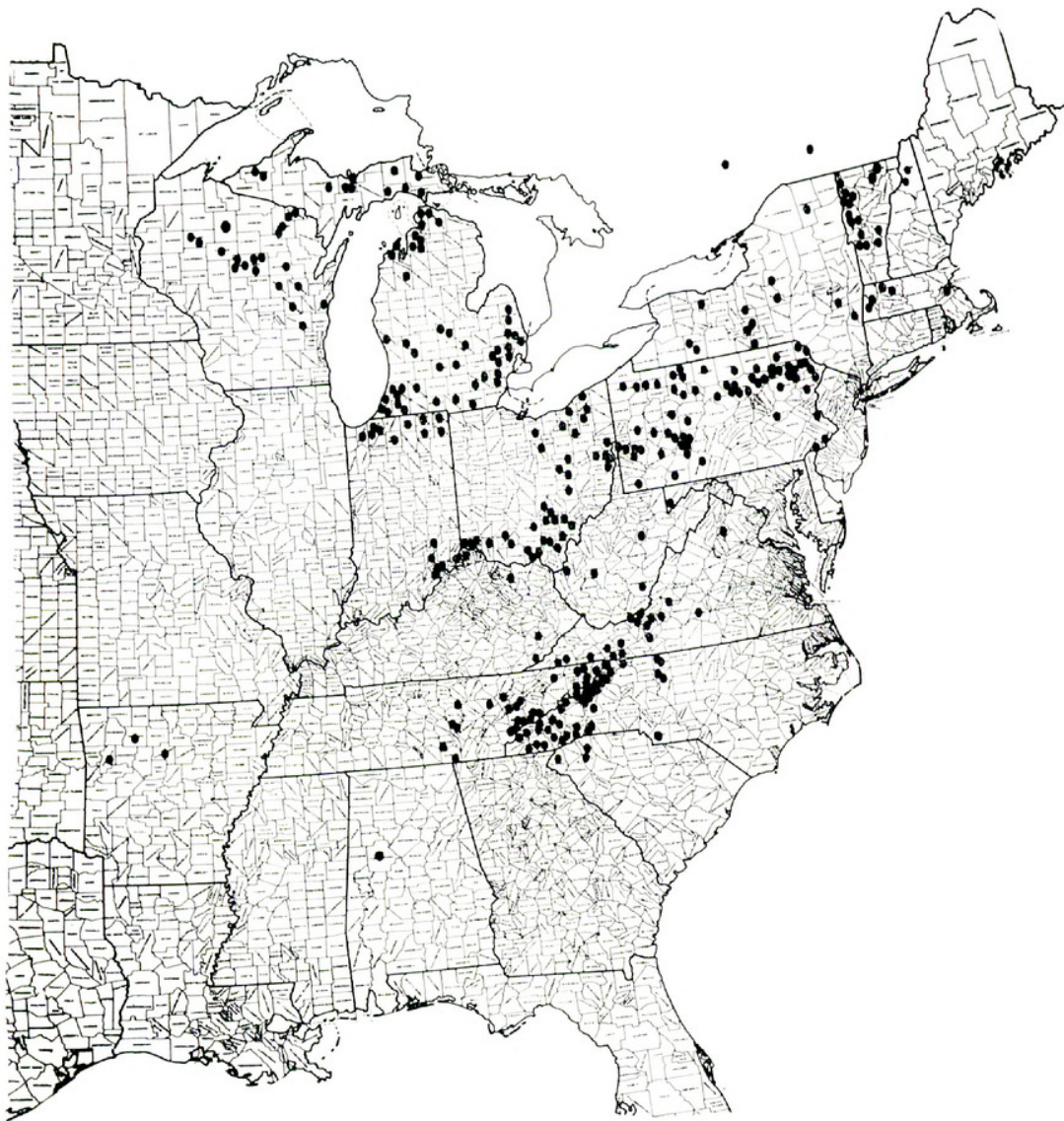
## GROUP V. STEMMED WHITE VIOLETS.

41. *Viola canadensis* L., Sp. Pl. 936. 1753.

41a. *Viola canadensis* var. *canadensis*.

This beautiful violet, like *V. adunca* and *V. nephrophylla*, occurs commonly both in northeastern United States and in the mountains of the west. It has been studied extensively in the Rocky Mountains, where the greatest morphological variation is found, by Mrs. Shirlee Cavaliere (Cavaliere and Russell, ms.), and the statements below are based in large part upon her observations and population analyses.

Taxonomists in the past have considered the *V. canadensis* complex as consisting of four species: *V. canadensis*, *V. rugulosa* Greene, *V. scopulorum* (Gray) Greene, and *V. rydbergii* Greene. Several other entities were named by E. L. Greene but reduced to synonymy by







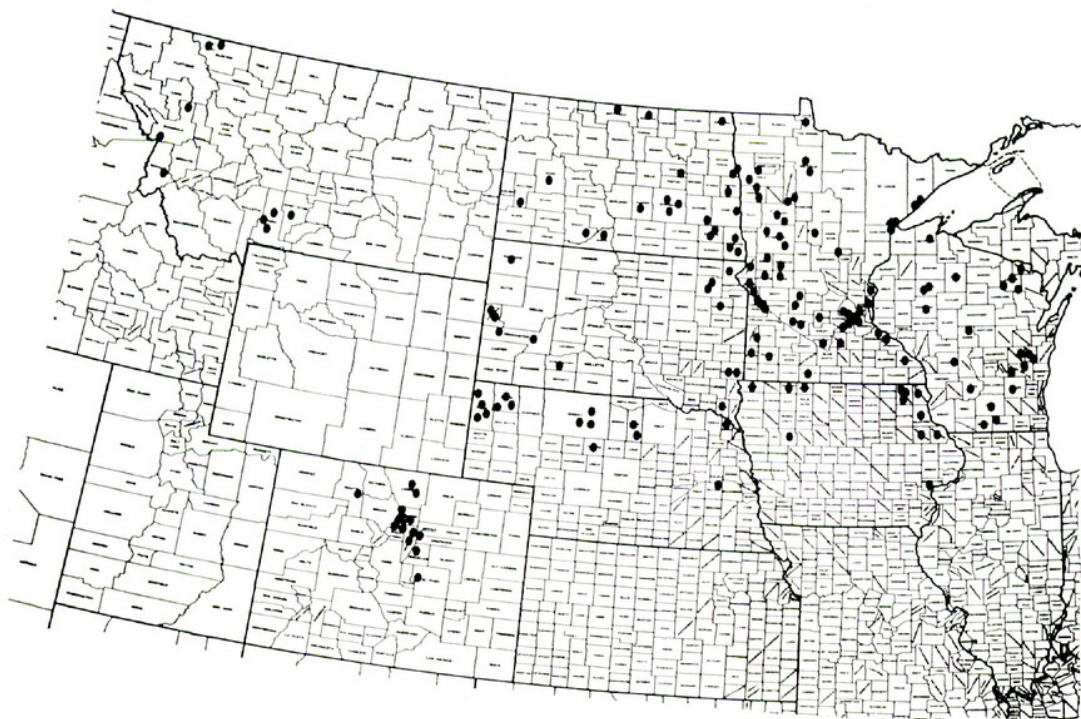
Brainerd (1921). I consider only a single species to be present, with an eastern and western form (var. *canadensis*), and a midwestern form (var. *rugulosa*). Mrs. Cavaliere was unable to find altitudinal or latitudinal forms in the Rockies. Both in the lower forests on the eastern front of the Rocky Mountains and in Wisconsin, where the two varieties meet, there is a gradual change from one to the other. In the Rockies there is a diminution in size of plants of var. *canadensis* at higher elevations, but this is not marked.

The two recognized varieties differ in a number of characteristics. Variety *rugulosa* has long, cord-like rhizomes, while variety *canadensis* ordinarily has short, slow-growing, thicker rhizomes. However this characteristic is not always constant. I have collected specimens of var. *canadensis* in the southern Appalachians and in New York with rhizomes like those of variety *rugulosa*. Indeed, based on just this characteristic, variety *rugulosa* has been reported in the east (Pratt, 1950).

Leaf shape differs in the two varieties. Variety *canadensis* has leaves about as long as broad, with attenuate apices, especially high on the flowering stem. Variety *rugulosa* has broad, reniform basal leaves with acute apices. Variety *rugulosa* tends to be slightly more hairy than variety *canadensis*, and its flowers are smaller with broader lateral petals. The petals of variety *rugulosa* are often completely purple-tinged on the back sides, and only partially so in variety *canadensis*.

41b. ***Viola canadensis* var. *rugulosa*** (Greene) C. L. Hitchcock, Vasc. Pl. Pacific N.W. 3: 442. 1961.

Miss Monserud's drawing is of a specimen from the type locality near Minneapolis, Minnesota, and illustrates very well the characteristics which separate variety *rugulosa* from variety *canadensis*. These are



discussed under the latter. In the Rocky Mountains Greene recognized a *Viola rydbergii*, but plants of this are not distinguishable from the more eastern ones which he placed under *V. rugulosa*.

*Viola canadensis* var. *rugulosa* grows in sandy soil in rather open, often disturbed, river forests. Occasionally it may occur in other habitats, such as open pine forests.





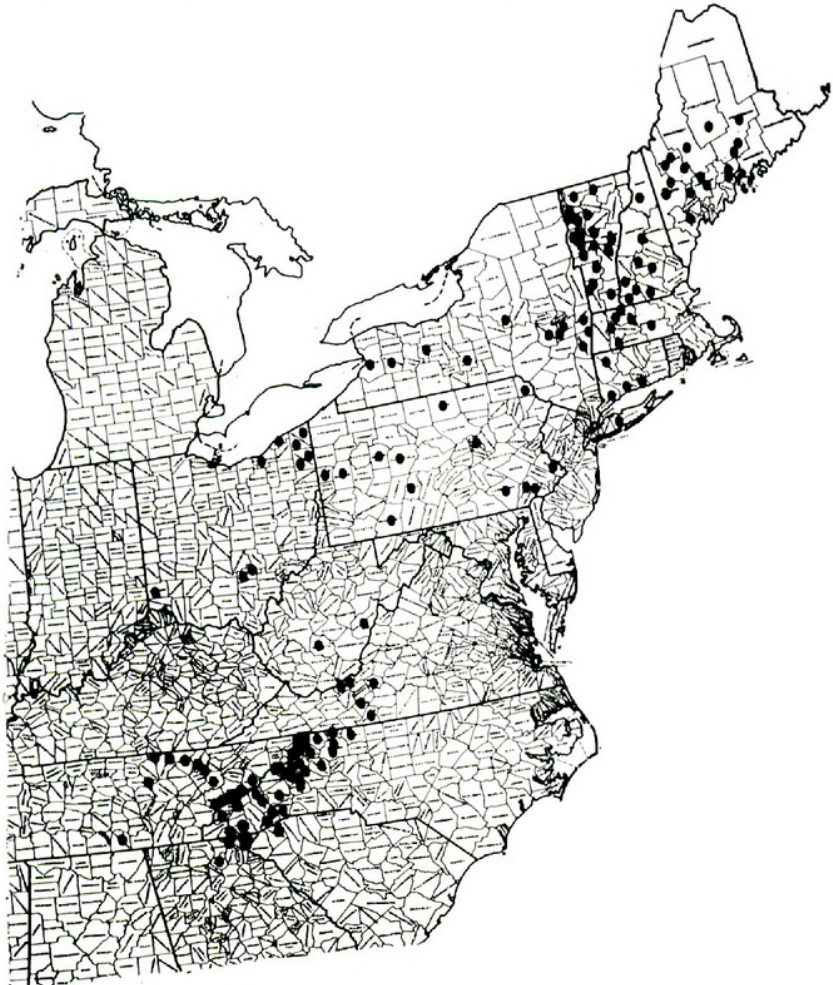
## GROUP VI. STEMLESS YELLOW VIOLETS.

42. *Viola rotundifolia* Michx., Fl. Bor.-Am. 2: 150. 1803.

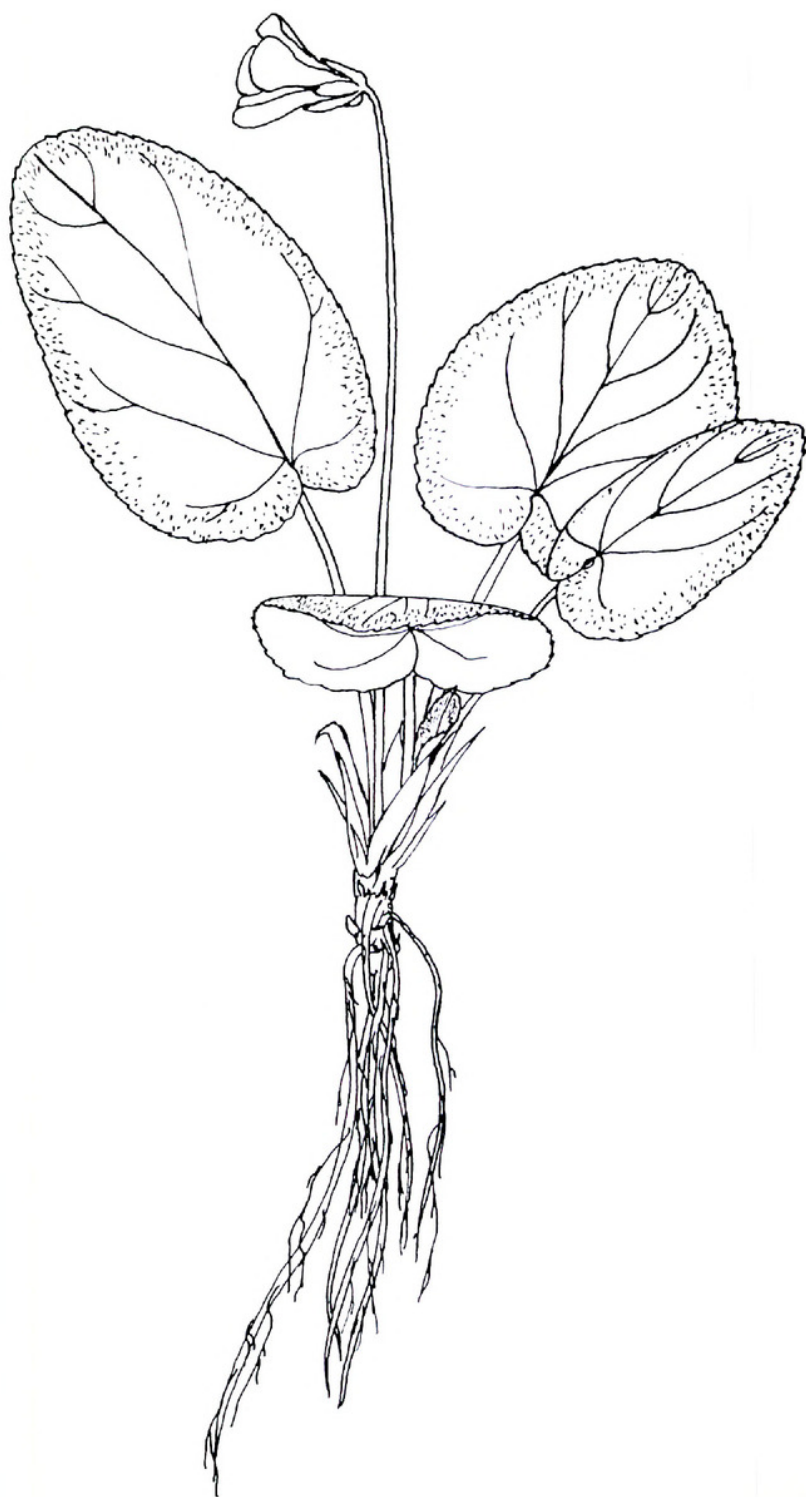
The nearest relative of this distinctive and beautiful violet is *Viola orbiculata* Geyer, native of the Pacific Northwest. *V. rotundifolia* is one of the most invariable of violets. In an earlier study (Russell, 1955a) no clinal variation in morphological characteristics could be found and little variation of any sort, for that matter.

*Viola rotundifolia* occurs in rich deciduous (especially beech) and hemlock-hardwood forests throughout its range, often forming mixed colonies with *V. blanda*. In the spring it can be distinguished by its small leaves and tiny yellow flowers; in summer by the large, oval, fleshy leaves which lie flat on the soil. In addition it sometimes produces raceme-like clusters of purple cleistogamous capsules. It is not known to hybridize with any other violet.

*Viola rotundifolia* has the lowest chromosome number known for North American violets ( $n=6$ , Gershoy, 1934) and may thus be considered one of the more primitive of violets (Clausen, 1929). Its western relative, *V. orbiculata*, has a chromosome number of  $n=12$  and may have arisen as an autopolyploid of *V. rotundifolia* or as an allopolyploid from a cross between *V. rotundifolia* and one of the stemmed yellow violets.



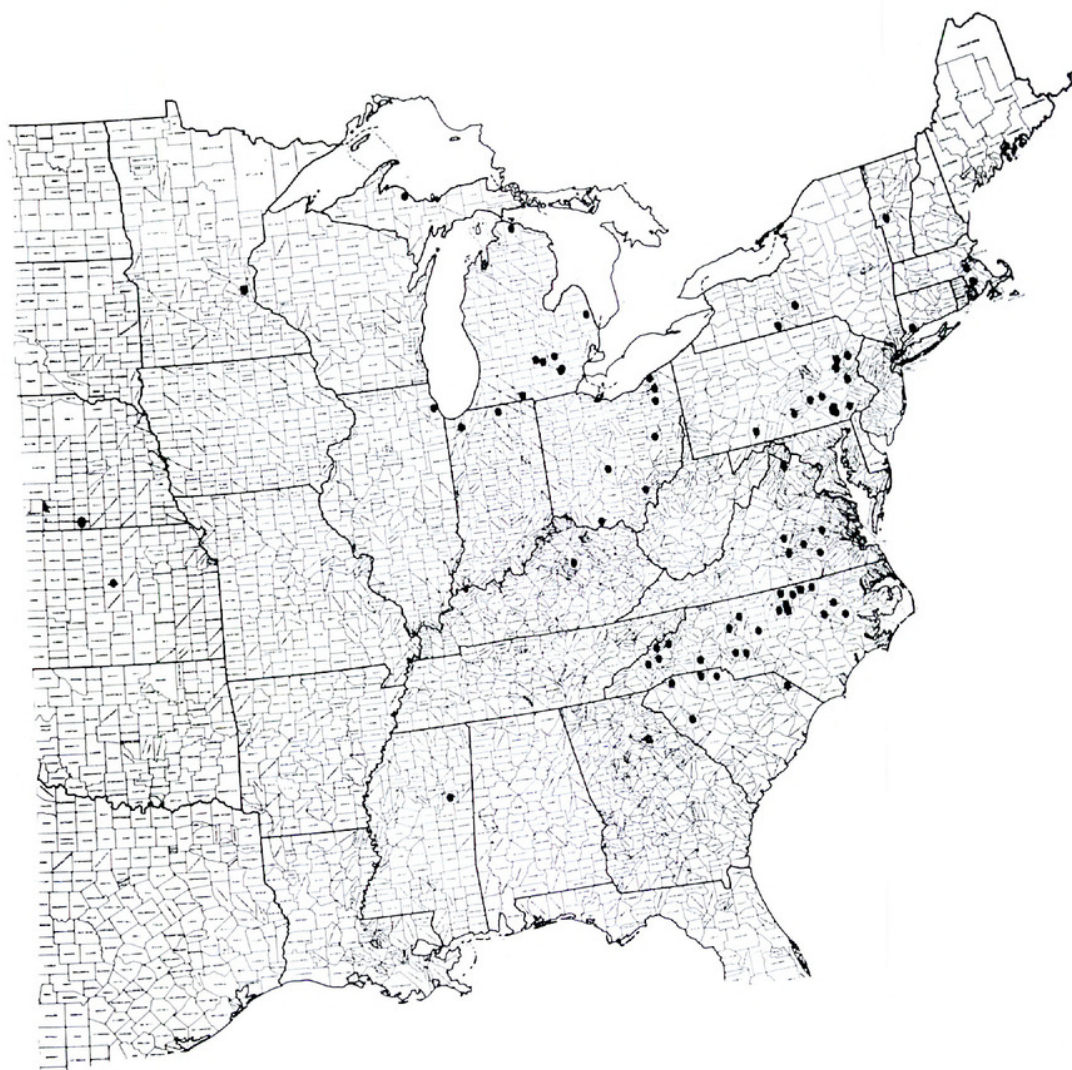




## GROUP VII. WILD PANSIES.

43. ***Viola arvensis*** Murray, Prodr. Stirp. Goetting. 73. 1770.

This species has been introduced from Europe and occurs sparingly in the United States, usually in or near cultivated fields or on weedy roadside banks. It is probably more common than the map shows, due to the tendency of many botanists to ignore weeds. Brainerd (1921) said that "sometimes it is a troublesome weed in the South." It resembles *V. rafinesquii* but differs in having more or less yellow petals equalled or exceeded by the sepals.

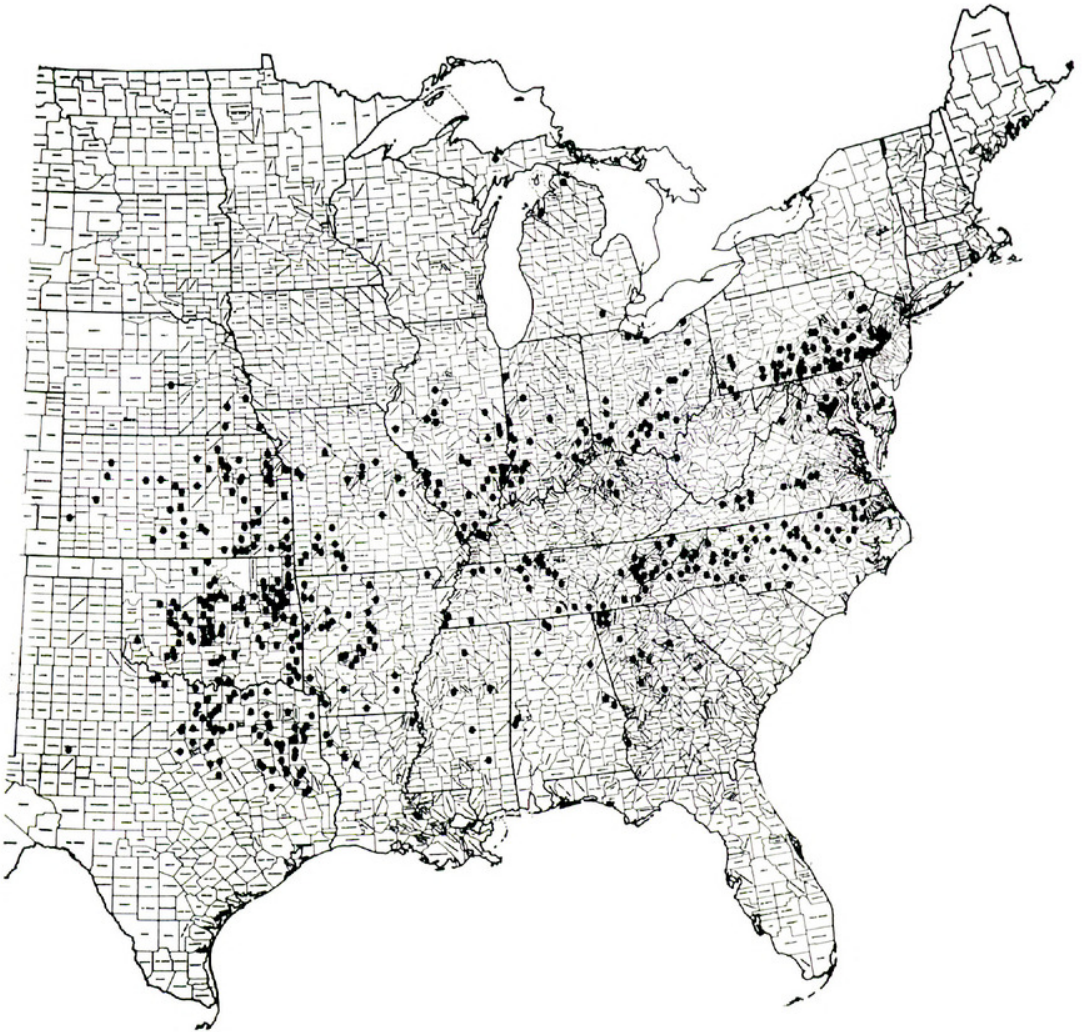




44. ***Viola rafinesquii*** Greene, Pittonia 4: 9. 1899.

This species has in recent years been called *V. kitaibeliana* var. *rafinesquii* and *V. bicolor*. Fernald, Asa Gray, and others maintained that it was introduced from Europe. My own strong conviction, based upon observations of its range and ecology, is that it is a native American species, a long-time member of the midwestern and southwestern flora, perhaps originally derived from Mexico. Shinnars (1961) and Clausen, Channell, and Nur (1964) have very convincingly presented the case for its acceptance as a native species of the United States.

*Viola rafinesquii* is a delicate, beautiful little violet, related to the wild pansies of Europe. It is an annual, and like most annuals is more abundant in some years than in others. In addition to the locations shown on the map, it has been collected near Boulder, Colorado (Brainerd, 1921), and at several locations near Payson on the Mogollon Rim in central Arizona.







## GROUP VIII. MISCELLANEOUS.

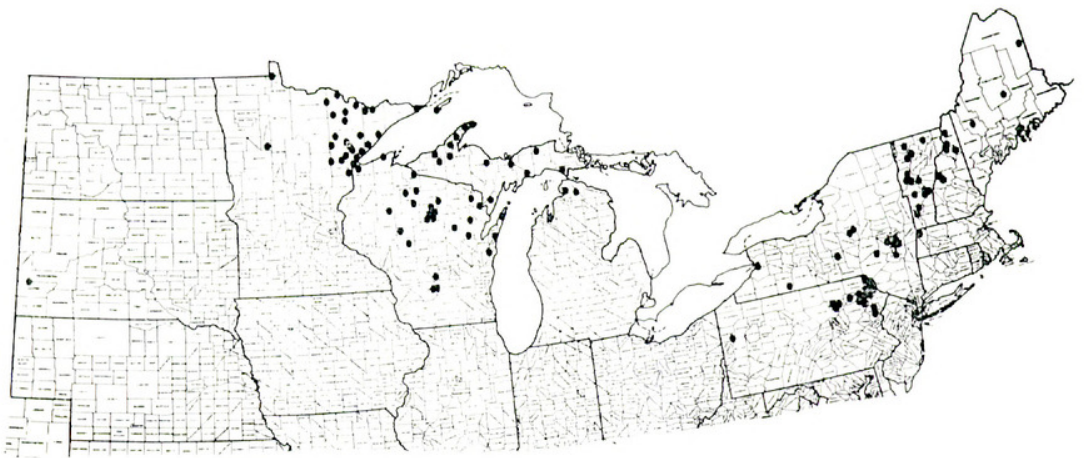
45. *Viola palustris* L., Sp. Pl. 934. 1753.

Though not uncommon in the subalpine zone of the Rocky Mountains, *V. palustris* is rare in eastern United States, reported only from the White Mountains of New Hampshire. It is a circumpolar species, found across Canada, in Alaska, and in northern Europe and Asia. It is most likely to be confused with *V. macloskeyi* subsp. *pallens*, with which it sometimes occurs in western North America, beside cold, open bogs or along mountain streams through alder thickets. *Viola palustris* differs from *V. macloskeyi* subsp. *pallens* in having larger, somewhat reniform leaves and thicker, somewhat cord-like green stolons. The flowers are often tinted lavender or light blue. In addition its petioles are never pubescent as those of *V. macloskeyi* subsp. *pallens* often are. Both its capsules and seeds are larger.

46. *Viola selkirkii* Pursh ex Goldie, Edinb. Phil. Jour. 6: 324. 1822.

*Viola selkirkii* is circumpolar, occurring in high latitudes in Greenland, Europe, and Asia. In North America it has been found from southern Labrador to northern British Columbia. It is quite distinct from other violets, and I know of no instance of natural hybridization. It usually grows under evergreens, particularly hemlock, frequently on rotting logs. The leaves are heart-shaped and scalloped, with conspicuous crenations. Other distinctive features are a slender, cord-like rhizome, and tiny, globose capsules.

In North America there is some evidence of east-west clinal variation, especially in lamina shape (Russell, 1956d). From Minnesota to eastern Quebec, there is an indistinct change from relatively narrow leaves (length/breadth ratio of about .95) to broader leaves (l/b ratio of about .85).



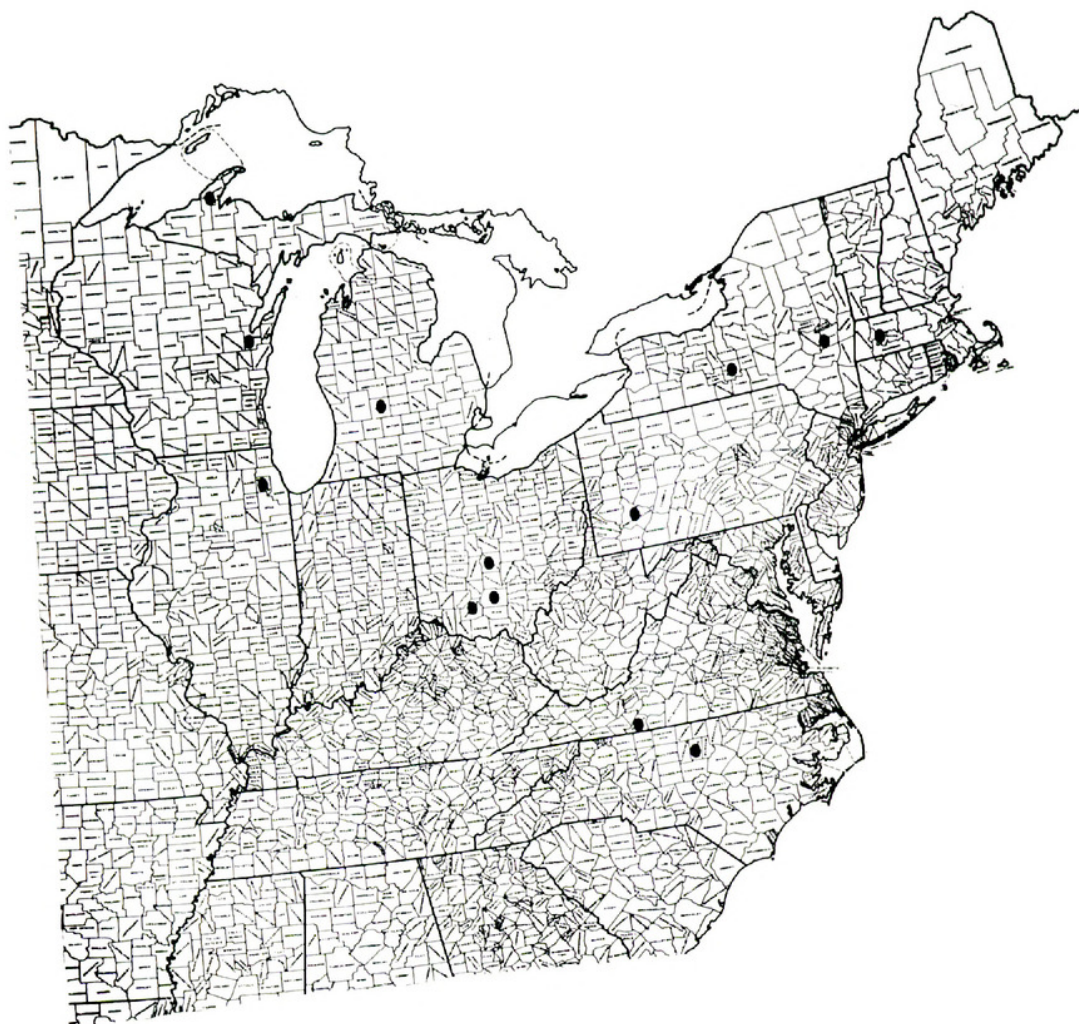


The past history of *V. selkirkii* has been the subject of speculation by several authors. As its closest relatives (morphologically) are all native to eastern Asia, Brainerd (1921) suggested that its ancestors may have arrived in North America from the west. The clinal variation may be interpreted to favor this view.



47. *Viola odorata* L., Sp. Pl. 934. 1753.

I have included this introduced violet because it seems to have established itself securely in several habitats, both cultivated lawns and woodlands. It superficially resembles a stemless blue violet, such as *V. sororia*, but can be easily distinguished because of its spreading stolons, which enable it to form large mats. So far as I know, it is not closely related to any North American violet.





## EXCLUDED SPECIES

*Viola emarginata* (Nutt.) LeConte. For a number of years I have puzzled over the nature of this morphologically indefinable violet. It seemed a catchall for a variety of violets which would not fit exactly into other species descriptions. In addition specimens of *V. emarginata* always seemed in some ways reminiscent of *V. sagittata*. In 1959 Mr. Arthur Risser and I made an extended trip on the southeastern coastal plain, collecting and studying population samples of "*V. emarginata*" wherever we found them, as well as the violets growing with them. It was our conclusion that violets labeled as *V. emarginata* are *V. sagittata* hybrids, the other parent usually, but not always, being either *V. affinis* or a member of the *V. affinis* complex (Russell and Risser, 1960)

*Viola latiuscula* Greene. This species is said to be characterized by lengthened sepal auricles, and the leaves sometimes 3-5 pedately lobed. I have been unable either in herbarium studies or in the field to distinguish a violet with these characteristics and that was not easily referable to *V. affinis*, *V. langloisii*, or *V. septemloba*. Fernald (1950) mentions another characteristic — "granulose-angled petioles." I have occasionally seen specimens from the Appalachians with peculiar granulations on the upper part of the petiole. As they occur sporadically and in all other respects are *V. affinis*, I do not consider them as worthy of a name.

*Viola stoneana* House. I have collected this violet several times in the southern Appalachians, in Virginia, North Carolina, and Tennessee and in addition have seen several dozen herbarium specimens so labeled. I have been unable to find any specific characters for this violet, and I strongly suspect the specimens referred to it represent a melange of hybrids, involving *V. sagittata*, *V. affinis*, *V. palmata*, *V. triloba*, *V. fimbriatula*, and perhaps other species. For this reason it is excluded from the present treatment. An unpublished analysis I made of a large population near Mountain Lake, Virginia, shows evidences of hybridization among *V. sagittata*, *V. cucullata*, and *V. fimbriatula*.

*Viola tricolor* L. This violet, the cultivated johnny-jump-up, occasionally escapes and is found wild. However, I do not believe it maintains itself in nature, and so have excluded it. The modern garden pansy, *V. × wittrockiana* Gams, is a complex hybrid with *V. tricolor* as only one of several species in its ancestry; it is often incorrectly referred to as *V. tricolor* (cf. Shinnars, 1958).

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