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Violaceae of Iowa

G. E. Newbro

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The Violaceae of Iowa

by

GRACE E. NEWBRO

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University of Iowa Studies in Natural History

G. W. MARTIN, Editor

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The Violaceae of Iowa

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V. papilionacea as belonging to the same small-leaved delicate plant with violet blossoms that appeared in the spring. Few people can devote their time to such a task. For this reason a systematic study of the genus in this state has not been made up to the present time and the collections that have been made are comparatively scanty. Probably the best collection is that made by Dr. B. Shimek and preserved in the herbarium of the State University. It contains a large series of specimens, some of which were taken systematically year after year from certain localities. Such a collection enables one to make a fair estimate of the range of variation within a given species.

Since there is so much variability in violets the question as to what is a species becomes vital. Shall differences in one character alone be sufficient to set off a plant as a distinct species? Attempts have been made to isolate single characters to be used as criteria for identification. Some have used the parts of the petaliferous flower as a basis for their key. This is especially noticeable in Gray (5), and Rydberg (7), in which the violets are divided as to the type of style and stigma. In Gray (5) such characters as the pubescence of the spurred petal and even the type of pubescence have been emphasized. Unfortunately, these characters, like many others, are subject to variation. Furthermore, the flowers are present only for a few short weeks in spring, hence these characters do not help in identifying a mid-summer specimen.

The importance of the cleistogamous capsule was given little attention until Brainerd (2) emphasized it by stating that it was by the cleistogamous capsules that the species were most easily recognized. In recent years the tendency has been to over-emphasize the importance of the cleistogamous capsules. This is illustrated in the keys in Britton and Brown (4), Rydberg (7) and Small (9), in which the acaulescent blue violets are divided into sections according to the cleistogamous flowers and their capsules. While it is true that these characters are important, they do not appear until late in summer and are therefore of little use in determining specimens collected in spring. The autumnal characters should be included in the key but in combination with vernal characters.

Another character which has been used rather freely in keys is the form and texture of the leaves. Unusual types such as the palmately parted leaves of *V. pedatifida*, the hastately lobed leaves

of *V. viarum*, or the ovate-lanceolate leaves with sharply toothed or incised bases of *V. fimbriatula* seem to adapt themselves well to a key. Yet these characters, like all other parts of the plant, are variable and change greatly with the seasons not only as to size but also shape.

Similar cases of fluctuation may be observed in almost any character which might be selected. These variations are usually considered as the results of mutation or hybridization. It has been proved that violets do hybridize but we are not sure that all of these doubtful forms found in nature are hybrids—they may be mutants. If a variation becomes so established that it remains constant, then surely one may be safe in considering this form a species.

We cannot ignore these variable characters, yet there must be some proper balance else the taxonomic value is lost. It would seem to be desirable to use a combination of characters rather than a single item to indicate a species, for the decisive character present in the key may be one which is lacking at the time when it is most needed.

The following paper consists of a description of the species of *Hybanthus* and *Viola* that occur in Iowa together with a key for their determination. The writer has attempted to take into account the variations that occur without uselessly adding new specific names. At the same time certain species have been included because they have been so widely recognized that they could hardly be omitted without causing more confusion.

Several botanists have endeavored to bring about some order from the chaos in which the violets have been thrown. But many of these attempts have resulted not in a more systematic arrangement but in greater confusion because of the multiplication of new names. In their attempt to make finer distinctions some have failed to take into consideration the variations within the genus as a whole. Perhaps Le Conte has best expressed the situation: "The desire which we all possess of seeming to comprehend the subject which we attempt to elucidate, inevitably leads us to suppose that our vague imaginations are the result of investigation and study; and thus a science which ought to be founded entirely upon facts, becomes as varying and unsettled as fancy itself, and our deductions loose, unsatisfactory, and unphilosophical. He who supposes that the ever varying forms of nature can be embraced

by the mind at one view, and arranged with as much ease as the books on the shelves of a library, knows but little of the science which he holds so cheap."

The work upon which this paper is based was done in the botanical laboratories of the State University of Iowa, under the direction of Professor B. Shimek.

Key to the *Violaceae* of Iowa

Key to genera

1. Sepals not auricled; petals equal in length; stamens united into a sheath—*Hybanthus*
a single sp. *Hybanthus concolor* p. 55
1. Sepals auricled; lower petal spurred; stamens distinct, the two lower spurred. *Viola* 2

Key to species of *Viola*

2. Plants stemless; leaves and scapes from a rootstock or runner. 3
2. Plants with leafy stems, flowers axillary. 18
3. Corolla violet or purple (white in albino forms), plant without stolons.
3. Corolla white, petals often with dark lines; plant stoloniferous except *V. renifolia*. 14
4. Petals beardless; cleistogamous flowers wanting; leaves pedately parted, the middle segment uncut. 5
4. Lateral petals bearded; cleistogamous flowers present; none of the leaves truly pedate. 6
5. Upper petals dark violet, the others pale to deep lilac purple.
V. pedata p. 62
5. All the petals of the same lilac-purple color.
V. pedata var. *lineariloba* p. 63
6. Leaf margins merely crenate-serrate, undivided. 7
6. Leaf margins sharply dentate toward the base or lobed or incised. 12
7. Plants mostly glabrous. 8
7. Plants pubescent. 10
8. Corolla pale violet with a darker band above the white or yellowish center; cleistogamous capsules purple dotted; seeds buff.
V. missouriensis p. 59
8. Corolla violet, white or greenish yellow at base; cleistogamous capsules green; seeds black. 9
9. Vernal leaves narrowly deltoid; cleistogamous capsules on erect, ascending peduncles.
V. lucidifolia p. 56
9. Vernal leaves cordate-ovate; cleistogamous capsules on horizontal peduncles (erect only when ripe) *V. papilionaceae* p. 58
10. Leaves hirsute on upper surface only, lower surface glabrous.
V. hirsutula p. 60
10. Leaves pubescent on both upper and lower surface. 11

11. Spurred petal villous; sepals usually closely ciliate to tip (occasionally ciliate only on auricles). *V. septentrionalis* p. 61
11. Spurred petal glabrous or bearing only a few hairs; sepals ciliate below the middle. *V. sororia* p. 62
12. Spurred petal glabrous; leaves broadly deltoid, some 3-7-lobed or parted, the middle segment broad, acute, serrate, glabrous. *V. viarum* p. 64
12. Spurred petal villous at base, lateral petals with capillary beard, leaves pubescent. 13
13. Leaves ovate-oblong to lanceolate, basal lobes sometimes sharply toothed or incised *V. fimbriatula* p. 65
13. Leaves variously cleft or incised into linear segments. *V. pedatifida* p. 63
14. Leaves oblong or lanceolate to elliptic. 15
14. Leaves cordate-ovate or reniform. 16
15. Leaves lanceolate or linear-lanceolate. *V. lanceolata* p. 66
15. Leaves oblong, ovate or elliptic, subcordate or tapering at base. *V. primulaefolia* p. 66
16. Leaves reniform, stolons lacking *V. renifolia* p. 66
16. Leaves cordate-ovate or orbicular; stoloniferous. 17
17. Leaves cordate-ovate, pointed, glabrous, smooth and glossy; cleistogamous capsules green. *V. pallens* p. 67
17. Leaves cordate-ovate to orbicular, rugose, slightly pubescent; capsules purplish. *V. blanda* p. 67
18. Petals white, outside tinged with violet; spurred petal yellow at base, striped with fine dark lines; sepals lanceolate. *V. canadensis* p. 68
18. Petals yellow; sepals large, leaf-like. 19
19. Stems often solitary, long and slender, softly pubescent; root leaves often wanting. *V. pubescens* p. 68
19. Stems 2-4, thickened, greenish or purplish, low and shrubby; sparingly pubescent; root leaves 1-2 *V. eriocarpa* p. 69

Hybanthus concolor (Forst.) Spreng. Syst. 1: 805. 1825.

Viola concolor Forst. Trans. Linn. Soc. 6: 309. 1802.

Solea concolor (Forst.) Ging. in DC. Prodr. 1: 306. 1824.

Cubelium concolor (Forst.) Raf. Cat. Bot. Gard. Trans. 13. 1824.

Ionidium concolor (Forst.) Benth & Hook f. ex. S. Wats. Bibliog. Index N. Amer. Bot. 81. 1878.

Plant pubescent, 3-9 dm. high; leaves alternate, oblong, lanceolate, acuminate, attenuate at base into a short petiole, entire or with a few lateral teeth near the apex; stipules linear, acute; flowers axillary, 8 mm. long, on recurved peduncles, sepals linear, about equalling the corolla, lower petal twice as broad as the others, gibbous at the base; capsule oblong, 1.5-2.5 cm. long, dehiscent by 3 valves; seeds large.

Habitat—moist woods and copses.

This species, which is rare in Iowa, occurs in the northeastern part of the state. It has been found at Pine Hollow in Dubuque County.

Viola lucidifolia sp. nov.

Folia verna anguste deltoidea, attenuata ad apicem, glabra; folia aestatis serae latiora sed acutissima; margo crenulatus-serrulatus; corolla violacea, alba aut subflava in faucibus; sepala ovate-lanceolata, glabra; petala lateralialia barbata; petalum cum calcar, glabrum aut villosulum; capsula cleistogama cylindrata, viridia, in pedunculis erectis; semina olivacea.

Vernal leaves narrowly deltoid, attenuate to the apex, dark green, very smooth; leaves of late summer broader but sharply pointed, margin crenate-serrate; petaliferous flowers 1.5-2.5 cm. across; corolla violet or paler, white or yellowish at the base; lateral petals bearded; spurred petal either glabrous or slightly villous, spatulate, often emarginate, shorter than the other petals, about equal in width to the lateral but narrower than the upper; spur 1-2.5 mm. long; sepals ovate-lanceolate, glabrous; cleistogamous capsules green, cylindrical or sometimes deltoid in cross section, 9-14x5-7 mm., their sepals ovate-lanceolate, glabrous, $\frac{1}{3}$ - $\frac{1}{2}$ the length of the capsule, auricles 1-2 mm. long; peduncle erect, 10-17 cm. long; seeds olive-brown, 1.8-2.2x1-1.2 mm; narrow as compared with the seeds of *V. papilionacea* and *V. missouriensis* and more seeds formed per capsule.

Habitat—prairie and sand.

Type—Iowa City, Johnson County, Iowa. Grace Newbro, April 6, 1935. In herbarium State University of Iowa.

A detailed comparison with other related species shows this species to be quite distinct.

The leaves differ in form from *V. cucullata*, *V. nephrophylla*, *V. latiuscula*, *V. papilionacea*, *V. Lunellii*, and *V. retusa* in having the early leaves narrowly deltoid, attenuate at the apex, and from *V. cucullata*, *V. latiuscula* and *V. papilionacea* in having the leaves entirely glabrous. This species also differs from *V. papilionacea* in having the leaves dark green and smooth. The later leaves of *V. lucidifolia*, like those of *V. missouriensis*, *V. affinis*, and *V. Langloisii*, broaden out during the summer.

Some violets resemble each other at certain seasons of the year. The early leaves of *V. lucidifolia* and *V. missouriensis* often look very similar. If the flower has disappeared the two species might

be indistinguishable to one who was not familiar with both. However, closer observation shows that the leaves of *V. lucidifolia* are usually smaller, more acute and more finely serrate as compared with the larger, obtuse, rather coarsely serrate leaves of *V. missouriensis*.

Violet leaves often change very much during the seasons. The vernal leaves of *V. lucidifolia* are narrowly deltoid, attenuate to the apex as shown in Plate VIII, fig. 24. Later in the season the leaves broaden to such an extent that one would hardly recognize them as belonging to the same species. This is illustrated on Plate VIII, fig. 25.

The flower of *V. lucidifolia* differs in color from those of *V. cucullata*, *V. nephrophylla*, *V. latiuscula*, *V. missouriensis*, *V. Langloisii* and *V. Lunellii* in being violet with white or yellowish base. The flowers of *V. cucullata* are violet, darker at the throat, those of *V. nephrophylla* are violet, those of *V. latiuscula* rich violet, of *V. missouriensis* pale violet with a darker band above the white center, those of *V. Lunellii* deep violet and of *V. Langloisii* violet.

The sepals differ from those of *V. cucullata* and *V. missouriensis* in being entirely smooth, from those of *V. affinis* in having more prominent auricles which stand out away from the peduncle and from those of *V. Lunellii* in lacking a gland or callosity at the apex.

The cleistogamous flowers differ from those of *V. latiuscula*, *V. papilionacea*, and *V. Lunellii* in being on erect or ascending peduncles. The cleistogamous capsules differ from those of *V. affinis*, *V. latiuscula*, *V. missouriensis*, and *V. Langloisii* in their green color and from *V. affinis* in being entirely glabrous. The colors of the capsules in the other species are as follows:

V. affinis usually purple dotted.

V. latiuscula flecked with purple.

V. missouriensis finely dotted with purple.

V. Langloisii pale yellow, faintly dotted with purple.

The seeds differ from those of *V. cucullata*, *V. affinis*, *V. missouriensis*, and *V. Langloisii* in being olive-brown. *V. cucullata* has nearly black seeds. The other species have buff seeds. The seeds also differ from those of *V. papilionacea* and *V. missouriensis* in being narrower. There is usually a larger number of seeds formed per capsule than in the case of *V. papilionacea* and *V. missouriensis*.

V. lucidifolia grows out in the open on prairie or sand where xeric conditions prevail. But *V. cucullata*, *V. nephrophylla*, *V. affinis*, *V. missouriensis*, *V. papilionacea*, *V. Langloisii*, and *V. Lunellii* are said to be found growing chiefly in low or wet places, though the writer has found *V. missouriensis* and *V. papilionacea* on prairies or in the woods.

The writer had first noticed the prevalence of this species in the dooryards and along the streets of Iowa City. The constancy with which the species reappeared each spring led her to believe that this is a definite species and not a hybrid, or else a hybrid that had become fixed.

Seeds of this form were collected and sown in the plant house. From them were developed plants which had the same characters as the plants from which the seeds were obtained. Unfortunately no count was made of seeds and plants so that the percentage of germination cannot be given.

In the spring of 1935 experiments were made to test the fertility of the pollen of this species. Also, as a check, pollen tests were made of *V. papilionacea*. From the flowers of four separate plants of *V. papilionacea* pollen grains were dissected and placed in four separate petri dishes in which had been poured a 2% solution of cane sugar. The petri dishes were set aside for a period of forty-eight hours after which the cultures were examined under a binocular microscope. Ten different fields were selected in each culture and the percentage of germination in each field was calculated. The average percentage of germination for each plant as well as the average for all four plants was so calculated. A similar test was made for *V. lucidifolia*.

Viola papilionacea, which has been recognized as a distinct species, had an average of 60.5% of the pollen grains germinating. *V. lucidifolia* had an average of 55% of the pollen grains germinating.

The fertile pollen together with the constancy with which these plants appear leads the writer to conclude that *V. lucidifolia* is a distinct species.

Viola papilionacea Pursh, Fl. Am. Sep. 1:173. 1816.

V. obliqua Hill, Ait. Hort. Kew. 3: 316. 1789?

V. cucullata var. α Le Conte, Observations on N. A. sp. of Genus *Viola*, Am. Lye. N. Y. 2: 138. 1828.

V. domestica Bicknell, Ex. Britt. & Br. Fl. N.U.S. 3:519. 1898.

V. pratincola Greene, Pittonia 4: 64. 1899.

Vernal leaves very roundly cordate-cucullate, obtuse, yellowish-green, rugose, glabrous or sparingly pubescent along the veins and petioles; leaves of late summer broadly cordate, sometimes 12 cm. wide, cucullate, obtuse or pointed; margin crenate-serrate; flower 0.8-2.8 cm. across; corolla purplish, white or yellowish at base; spurred petal usually shorter than the others, about equal in width to the lateral but narrower than the upper, glabrous or sometimes slightly villous, spur 1.5-3 mm. long; cleistogamous flowers on short, stout, green or purplish peduncles horizontal at first, becoming erect when the capsule ripens; capsule ellipsoid to cylindric, 5-8 x 9-13 mm., green; sepals ovate-lanceolate, about one-half the length of the capsule, glabrous or sometimes slightly ciliate, auricles rounded and appressed, about 1.5 mm. long; seed olive-brown, 2.3-2.5 x 1.35-1.5 mm.

Habitat—prairie, woods and sand.

Brainerd (5) describes the leaves as deltoid in outline above the cordate base, sometimes rounded and abruptly pointed. The striking difference in form and size between the vernal leaves and the autumnal leaves is also noteworthy and is illustrated on Plate VIII, figs. 22 and 23.

The spurred petal has been described as "usually glabrous" but the writer finds this character variable, either glabrous or sometimes slightly villous. The size of the cleistogamous capsules has been cited as being 10-15 mm. long, but the writer finds them to vary from 9-13 mm. Further observations showed the sepals to be one-half the length of the capsule; auricles about 1.5 mm. long; and the seed 2.3-2.5 x 1.35-1.5 mm. which is wider than the seeds of *V. missouriensis* and *V. lucidifolia* and longer than the seeds of *V. lucidifolia*. A study of a large group of plants from various parts of the state showed the habitat to be chiefly prairie and woods, occasionally swamp and sand. Measurements are those of the writer. This species is very common.

Viola missouriensis Greene, Pittonia 4: 141. 1900.

Vernal leaves narrowly deltoid with cordate base, or sometimes broader with rounded basal lobes and pointed apex, margin rather coarsely crenate-serrate, almost entire just below the apex; leaves of late summer broadly deltoid, wider than long, obtuse, coarsely crenate-serrate; corolla pale violet with a darker band above the white or yellowish center; lateral petals bearded, spurred petal

obtuse, glabrous, spur 1.5-2 mm; sepals ovate-oblong to lanceolate, obtuse, narrowly white-margined, glabrous or slightly ciliate; cleistogamous flowers on erect peduncles; cleistogamous capsules broadly ellipsoid, finely dotted with purple, 9-16 x 4.5-7 mm; seeds buff, 1.7-2.2 x 1.5-2 mm.

Habitat—sandy openings and sandy woods.

Brainerd puts this species in the group having cleistogamous capsules on prostrate peduncles, but the Iowa form has cleistogamous capsules on erect peduncles.

The measurements of capsules and seeds are those of the writer. The seeds are slightly wider and shorter than those of *V. lucidifolia*.

The late summer leaves have been described as being as long as broad but the writer finds them usually wider than long. Plate VIII, figs. 20 and 21, shows the difference in form of the spring leaves and summer leaves.

Brainerd (5) cites as habitat, river bottoms and low woods but the writer finds this species growing in sandy openings or sandy woods.

This species is not as common as *V. papilionacea* but is frequent.

Viola hirsutula Brainerd, Rhod. 9: 98. 1907.

V. villosa Walt. & Elliott, ex. Nutt. Gen. N. A. Plants 1: 148. 1818.

Plant of small size; leaves 2-4 cm. wide, broadly cordate-ovate to reniform, purplish and glabrous beneath, upper surface silvery pubescent; vernal flowers violet-purple on peduncles taller than the leaves; lateral petals bearded; spurred petal villous, spur about 4 mm. long, very blunt; cleistogamous capsules ovoid, 6-8 mm. long, purple when ripe; seeds light brown.

Habitat—dry rich woods.

This species appeared for many years under the names of *V. villosa* Walt. or *V. sororia* Willd. owing to errors made by Nuttall in his Genera of North American Plants. He believed the plant with leaves hirsutulous only above to be *V. villosa* Walt. He also regarded *V. sororia* Willd. as only a synonym of the supposed *V. villosa*. Le Conte (6) followed Nuttall in regarding *V. sororia* as a synonym of *V. villosa*. Brainerd has corrected these mistakes in his Violets of North America.

The Iowa form of *V. hirsutula* has the leaves entirely glabrous except for a very few stiff hairs along the veins of the upper sur-

face. Glandular, red dots are often quite conspicuous on the lower surface of the leaves.

Brainerd cites as habitat dry rich woods, but in Iowa this species occurs usually on swampy ground or on low prairie. It is not very common but has been found in eight different counties.

Viola septentrionalis Greene, Pittonia 3: 334. 1898.

V. Macouni Greene, Pittonia 3: 335. 1898.

V. subviscosa Greene, Pittonia 4: 293. 1901.

V. Fletcheri Greene, Pittonia 4: 296. 1901.

V. nesiotica Greene, Pittonia 5: 102. 1902.

Plant 6-20 cm. in height; leaves 3-7 cm. wide, ovate-reniform, cordate, somewhat pointed but the apex blunt, hirsutulous, especially on the margins, veins, and petioles; petioles slender, almost wiry, often purplish at the base; petals variable, deep violet to lilac, rarely pure white or white suffused with violet, all occasionally bearing scattered hairs at the base, sepals ovate, usually obtuse, closely ciliate to the tip; cleistogamous capsules purplish, subglobose, sepals with spreading ciliate auricles; seeds dark brown.

Habitat—prairie and woods.

V. septentrionalis resembles *V. sororia* but is a smaller and more delicate species. The younger leaves of *V. septentrionalis* are silvery pubescent but the mature leaves are often quite glabrous. On the contrary, both the young and mature leaves of *V. sororia* are wooly pubescent.

One of the characters of *V. septentrionalis* which has been emphasized is the pubescence of the sepals, which are closely ciliate to the tip, in contrast with the sepals of *V. sororia* which are ciliate below the middle. But the Iowa form of *V. septentrionalis* has sepals which are extremely variable as to pubescence. Some have the sepals closely ciliate to the tip while in others the sepals are ciliate only to the middle or only on the auricles.

Since this form so closely resembles *V. sororia*, except in size and degree of pubescence, the writer would prefer to unite the two species, but inasmuch as *V. septentrionalis* has been so widely recognized it has been included.

Brainerd (5) says this species is found in "moist open woodlands especially under conifers." The writer finds it fairly common both on prairies and in the woods.

Viola sororia Willd. Enum. 263. 1809.

V. cuspidata Greene, Pittonia 3: 314. 1898.

V. Dicksonii Greene, Pittonia 4: 65. 1899.

V. nodosa Greene, Pittonia 4: 296. 1901.

V. palmata var. *sororia* (Willd.) Pollard, ex. Britt. Fl. N.U.S. and Canada. 1905.

Plant 6-18 cm. in height, leaves cordate-ovate, orbicular or even reniform, obtuse or short-pointed, blades 10-17 cm. wide when mature, villous pubescent on veins and petioles and under surface when young, margin crenate-serrate; vernal flowers on peduncles about the length of the leaves, violet, lavender, white spotted with lavender or occasionally white; spurred petal glabrous or bearing only scattered hairs, spur 2-2.3 mm.; sepals ovate-oblong, commonly obtuse, ciliate below the middle and on short rounded auricles; cleistogamous capsules oblong on short prostrate peduncles, lengthened and erect when the capsule ripens, mottled with purple; seed dark brown, almost black, about 2.1 mm. long x 1.3 mm. wide.

Habitat—chiefly woods; also moist meadows, shady ledges and dooryards.

Brainerd (5) says of this species "In size and habit of no. 7 [*V. papilionacea*] into which it passes." This quotation illustrates the vague and indefinite character of many of these descriptions. Such descriptions make identification of material difficult.

V. sororia differs from *V. papilionacea* in two definite characters: its pubescence and the color of the cleistogamous capsules. The leaves of this species often get to be quite wooly, as contrasted with the smooth leaves of *V. papilionacea*. The cleistogamous capsules are purplish mottled as contrasted with the green capsules of *V. papilionacea*.

V. sororia often becomes quite robust during the summer. Some specimens measure as much as 40 cm. in height with leaves 17 cm. across. It is more pubescent, larger and coarser than *V. septentrionalis* and *V. hirsutula* although dried specimens of *V. sororia* are sometimes difficult to distinguish from *V. septentrionalis*.

This species is very common in the woods.

Viola pedata L. Sp. Pl. 933. 1753.

V. flabellifolia Lodd. Bot. Cab. t. 777. 1777.

V. digitata Pursh, Fl. Am. Sep. 1: 171. 1816.

V. pedata var. *bicolor* Pursh? Raf. in DC. Prodr. 1: 291. 1824.

V. pedata var. *atropurpurea* DC. Prodr. 1: 1824.

V. ampliata Greene, Leaflets Bot. Obs. 1: 3. 1903.

Nearly glabrous; rootstock short, erect, not scaly; leaves 3-divided, the lateral divisions 3-5 parted or cleft, the segments all linear or narrowly spatulate, often 2-3 toothed or cleft near their apex, the leaves of early spring or of autumn often less deeply dissected; flowers 2-3 cm. broad, the upper petals dark violet, the others pale to deep lilac-purple, all beardless; the orange tips of the stamens large and conspicuous at the center of the flower; capsules green, glabrous; seeds copper colored; apetalous flowers wanting but petaliferous flowers often produced late in summer and autumn.

Habitat—prairie and sand.

This species has sometimes been confused with *V. pedatifida* because of the similarity of the foliage of the two species. Although both species have their leaves deeply dissected, *V. pedata* produces leaves which are truly pedately parted, the middle segment being uncut; but the leaves of *V. pedatifida* are palmately parted with the middle segment dissected. Other characters which should serve to separate these two species are:

V. pedata

1. Leaves glabrous.
2. All petals glabrous.
3. Large conspicuous orange stamens.
4. Cleistogamous flowers absent.
5. Upper petals dark violet, the others pale to lilac-purple.

V. pedatifida

1. Leaves more or less pubescent.
2. Lateral petals bearded.
3. Inconspicuous stamens.
4. Cleistogamous flowers present.
5. All the petals of the same color.

Viola pedata var. *lineariloba* DC. Prodr. 1: 1824.

V. pedata L. ex Gray's Man. ed. 6. 1890.

All petals of the same lilac-purple color.

Habitat—sandy prairie.

This variety seems to be more common than the species in Iowa.

Viola pedatifida G. Don, Gen. Sys. Gard. Dick. 1:320. 1831.

V. delphinifolia Nutt. Torrey and Gray Fl. N.A. 1:136. 1838.

V. indivisa Greene, Pittonia 5:124. 1903.

Rootstock short, vertical; leaves palmately parted, the divisions variously cleft and incised into linear lobes, the lobes usually cuneate at the base with prominent flabelliform veins, minutely pubescent on the margin; scapes usually exceeding the leaves, bearing

showy violet flowers; lateral petals bearded; cleistogamous capsules green, 10-15 mm. long on peduncles commonly shorter than the petioles; seeds 1.2 x 2.2 mm., light brown.

Habitat—prairie.

Although this species is extremely variable as to leaf form there is no sufficient cause for separating it into further species. Brainerd (5) states: "Varies much in leaf pattern passing through forms less deeply dissected and with wider oblong lobes (*V. Bernardii* Greene) to forms with leaves somewhat rhomboidal in outline, the base broadly cuneate and entire, the upper contour rounded, sharply cleft and toothed (*V. indivisa* Greene.)"

In early spring a plant of this species may produce leaves which are deeply dissected with narrow segments. In autumn the same plant may produce leaves with margins merely toothed or incised but not cleft. Also a group of these plants may be found growing together exhibiting all gradations of leaf form. Some of the more extreme forms of this species resemble *V. viarum* and the lobed forms of *V. fimbriatula*. The leaves of *V. pedatifida* have also been mistaken for *Delphinium*.

There has been some disagreement as to the color of the cleistogamous capsules. Brainerd (5) cites for the color of the cleistogamous capsules light gray. But Britton and Brown (4) describe the color of the cleistogamous capsules as yellowish. The writer finds the color of the capsules green, and only yellowish or brownish when the whole plant dies.

This species is very common on the prairies.

Viola viarum Pollard, ex Britt. Fl. N. U. S. 635. 1905.

Leaves broadly deltoid with basal angles rounded, some undivided, merely crenate-serrate or with a few incisions, others hastately 3-7-lobed or parted, middle segment broad, acute, serrate, glabrous; petaliferous flowers rich violet; lateral petals narrow, convergent around the spurred petal and bearing a short, clavate beard; upper pair broadly divergent emarginate; spurred petal glabrous, narrow emarginate, nearly tubular from the inrolling of the margins; sepals narrowly lanceolate with rather short, entire auricles; cleistogamous capsules on peduncles somewhat shorter than the petioles, pale green when ripe; cylindric-ovoid; seeds olive-brown.

Habitat—open ground, waysides and river banks.

This species is not very common but occurs in the western part of the state on prairie and dry exposures.

Viola fimbriatula J. E. Smith, Rees' Cycloped. 37. 1817.

V. sagittata var. *ovata* T. & G. Fl. N.A. 1:138. 1838.

V. primulaefolia Pursh, Fl. Am. Sept. 1:173. 1816.

V. ovata Nutt. Gen. Am. 1:148. 1818.

Rootstock long and stout, usually erect; earliest leaves ovate, obtuse; later leaves ovate-oblong to lanceolate, acute, finely pubescent, obscurely crenulate toward the apex, basal lobes sometimes sharply toothed, incised or auriculate, short petioled; petaliferous flowers violet-purple, peduncles commonly longer than the leaves, spurred petal villous; sepals lanceolate, auricles spreading and ciliate; cleistogamous flowers on erect peduncles, capsules green, ovoid, 6-10 mm. long; seeds 1.5 x 0.9 mm., brown.

Habitat—sandy fields and dry hillsides.

Brainerd (1) distinguishes *V. fimbriatula* and *V. sagittata* as follows:

Leaves pubescent, mostly short petioled, ovate-oblong, crenate-serrate only at base. *V. fimbriatula*.

Leaves glabrous, rather long petioled, lanceolate at base, often dilated and incised. *V. sagittata*.

But *V. fimbriatula*, as now limited, has the basal lobes of the leaves sometimes sharply toothed or incised (5). If the character of the leaf base be omitted, the remaining critical characters are length of petiole, form and texture.

A large series of specimens of *V. fimbriatula* from various parts of the state were studied with the following results:

1. The Iowa specimens had long petioles or long and short petioles on the same individual; or sometimes a group of plants were found growing together some bearing long petioles, others short petioled.

2. The blades of the leaves also varied in shape and size, some merely ovate, others ovate-oblong to lanceolate.

3. Sometimes the base of the leaves was merely crenate but in others it was sagittately incised.

4. The Iowa specimens were pubescent.

5. The habitat was chiefly prairie or sand.

V. fimbriatula is said to be found on sandy fields and dry hillsides and *V. sagittata* grows on moist banks and fields.

It is concluded that in the Iowa form of *V. fimbriatula* length

of petiole and form of leaf blade is not a stable character. Pubescence and habitat were the only characters left to distinguish this species from *V. sagittata*. This conclusion would seem to indicate that the difference between the two species is purely ecological.

This species occurs frequently on the prairie.

Viola lanceolata L. Sp. Pl. 934. 1753.

V. attenuata Sweet, Hort. Brit. 3 ed. 54. 1839.

Leaves lanceolate or linear lanceolate, 10-15 mm. wide x 7-15 cm. long, glabrous, 5-8 cm. high at vernal flowering; later leaves 20-30 cm. high, the blades obscurely crenulate, gradually tapering into a long, margined, often reddish petiole; rootstock slender, vernal flowers white with purple lines on the three lower petals, lateral petals usually beardless (sometimes with a few white hairs); sepals lanceolate, acute or acuminate; stolons rooting at the nodes and bearing cleistogamous flowers; cleistogamous capsules ellipsoid, green, 6-12 mm. long on erect peduncles that are usually shorter than the leaves; seeds dark brown.

Habitat—open bogs, moist meadows, marshes and shores.

This species is local but occurs rather plentifully at the edges of a small pond in Muscatine county.

Viola primulaefolia L. Sp. Pl. 934. 1753.

V. acuta Bigel. Fl. Bost. 2 ed. 95. 1824.

Leaves oblong or ovate with either subcordate, obtuse or tapering base, obscurely crenate-serrate, acute, glabrous or sometimes somewhat pubescent especially toward the base of the petioles; petioles often broadly winged above; rootstock slender; vernal flowers 3-17 mm. across, white with purple lines on the three lower petals; sepals lanceolate, acuminate; cleistogamous capsules ellipsoid, green, 6-12 mm. long, on erect peduncles that are usually shorter than the leaves; seeds reddish brown, about 1.5 mm. long.

Habitat—bogs.

This species is rare in Iowa and has been found in only one locality in Muscatine county.

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

V. blanda var. *renifolia* Gray, Bot. Gaz. 11:255. 1886.

Leaves reniform, often abruptly pointed, more or less pubescent, upper surface often glabrous, distantly crenate-serrate; petaliferous flowers 8-12 mm. across; petals white, all beardless, the upper

pair orbicular; sepals narrowly lanceolate; flowering early; runners rarely present, very short, raceme-like, bearing cleistogamous flowers.

Habitat—woods.

The habitat of this species has been cited as Arbor Vitae swamps and cold woods. The Iowa specimens were found in only one locality in rocky or upland woods at Pine Hollow in Dubuque County.

Viola pallens (Banks) Brainerd, Rhod. 7: 247. 1905.

V. rotundifolia var. *pallens* Banks, in DC. Prod. 1: 295. 1824.

V. blanda Willd, ex. Le Conte, Ann. Lye. N. Y. 2: 1828.

Leaves cordate-ovate, obtuse, or rarely acute, glabrous, smooth and glossy, 1-3.4 cm. broad; petioles sometimes dotted with red; rootstock slender; vernal flowers larger than those of *V. blanda*, 8-18 mm. across, white with purple lines on the three lower petals, lateral petals usually glabrous or sometimes with a few hairs; upper petals broadly obovate; sepals ovate-lanceolate, entire; stolons often bearing small leaves and cleistogamous flowers; cleistogamous capsules ellipsoid, green on erect peduncles, seeds small, 1 mm. long, almost black.

Habitat—bogs.

Le Conte (6) supposed that this species was *V. blanda* Willd. and used the name *V. amoena* for the true *V. blanda*. This error was not corrected until 1905 when Britton proved that *V. amoena* was Willdenow's *V. blanda*. Brainerd then adopted the name *V. pallens* for Le Conte's *V. blanda*.

The cordate-ovate, glabrous and glossy leaves with open sinus distinguish this species from *V. blanda*, with rugose, slightly pubescent, almost orbicular leaves with very narrow sinus. The flowers of this species are larger than those of *V. blanda*.

V. pallens is a rare species. It was found growing in the same habitat with *V. primulaefolia* in Muscatine County.

Viola blanda Willd. Hort. Berol., t. 24. 1806.

V. amoena Le Conte, Ann. Lye. N. Y. 2: 144. 1828.

V. Leconteana G. Don. Gen. System 1: 324. 1831.

V. blanda var. *palustriformis* Gray, Bot. Gaz. 11: 255. 1886.

V. alsophila Greene, Pitt. 4: 7. 1899.

Leaves rugose, cordate-ovate to orbicular, with very narrow sinus,

commonly acute, often pointed, 1.4-5 cm. broad in spring, sometimes 10 cm. broad in mid-summer, usually glabrous, sometimes with minute hairs along the veins, especially on the upper surface on the basal lobes; midribs, petioles and scapes usually tinged with red; freely producing in summer slender leafy stolons; vernal flowers small, 10-12 mm. across, white with purple lines on the three lower petals; lateral petals beardless, the upper pair often long, narrow and strongly reflexed, sometimes twisted; cleistogamous capsules ovoid, usually purplish, on erect peduncles only when ripe; seeds brown, 1.5-2 mm. long.

Habitat—moist rich woodlands, and cool ravines.

The leaves of this species are 2½-4 cm. wide as compared with the leaves of *V. pallens* which are 1-1.5 cm. wide. For further detailed comparison see *V. pallens*.

Viola blanda, like all the other white acaulescent violets, is rare in Iowa. It was found growing in half shaded damp places at the base of a rocky ledge at Wild Cat Den, Muscatine County.

Viola canadensis L. Sp. Pl. 936. 1753.

Minutely pubescent, glabrate, 3-4 dm. high; leaves cordate-ovate, pointed, serrate, acute or acuminate; stipules sharply lanceolate, entire, lower more or less scarious; petaliferous flowers single from the axils of the cauline leaves; petals white, tinged inside with violet, lateral petals bearded, spurred petal yellow at base and striped with fine dark lines; sepals slender, acuminate, subulate, spreading; cleistogamous capsules ovoid to subglobose, 6-10 mm. long, often downy puberulent; seeds brown, 2.2 x 1.5 mm.

Habitat—woods.

In early spring this species develops a leafy stem bearing flowers in the axils of the leaves. After forming its seed the stem dies leaving only the basal leaves. Late in summer these orbicular leaves might easily be mistaken for a new acaulescent violet.

The most striking characters, aside from the beautiful white flowers, are the orbicular leaves and lanceolate stipules.

This species is not very common in Iowa but occurs in the northeastern part of the state.

Viola pubescens Ait. Hort. Kew. 1 ed. 3:290. 1789.

V. pennsylvanica Michx. Fl. Bor. Am. 2: 149. 1803.

Softly pubescent; stems often solitary, mostly stout, 2-3.5 dm. high; leaves 2-4, near the summit (or occasionally with one or

more long-petioled root leaves) broadly cordate-ovate or reniform, with cordate or truncate-decurrent base, crenate-dentate, somewhat pointed; stipules large, ovate-oblong or ovate-lanceolate; petaliferous flowers bright yellow, purple veined, the lateral petals bearded, the lower with a short spur; sepals narrowly lanceolate, acute; cleistogamous flowers on short peduncles, abundant in summer; cleistogamous capsules ovoid, conic, 10-12 mm. long, glabrous or wooly; seeds light brown, large, 2.3 x 1.47 mm.

Habitat—dry rich woods, mostly upland.

Although descriptions of this species state the stems are solitary with seldom any root leaves, there occur in Iowa plants which in all other characters are *V. pubescens* but which have more than one stem and as many as three root leaves.

This species is fairly common but does not occur as frequently as *V. eriocarpa*.

Viola eriocarpa Schw. Amer. Jour. Sci. 5:75. 1822.

V. pubescens var. *scabriuscula* T. & G. Fl. N. A. 1: 142. 1838.

Sparingly pubescent to glabrate; stems 2-4, stout, reddish, glabrous, shorter and more leafy than *V. pubescens*; cauline leaves only on upper half of the stem, broadly ovate, subcordate, acuminate, the uppermost smaller, truncate, nearly sessile; radical leaves 1-5, ovate to reniform, cordate or truncate, mostly pointed; petaliferous flowers bright yellow, purple veined, lateral petals bearded, spurred petal glabrous; sepals narrowly lanceolate, ciliate on the auricles; cleistogamous capsules ovoid, wooly or sometimes glabrous; seeds 2.3 x 1.5 mm., brown.

Habitat—mostly woods, especially alluvial woods; occasionally found on prairie and sometimes on low or wet ground.

Schweinitz in an earlier manuscript, which was not published, called this species *V. scabriuscula*. The species appeared erroneously under the name of *V. scabriuscula* in the first edition of Britton and Brown (3), the seventh edition of Gray's Manual (5) and the first edition of Small (8). The error was corrected in the second edition of Britton and Brown (4), and in the third edition of Small (9), and in Rydberg (7), as well as Brainerd's Violets of North America (1).

Brainerd (5) says "similar to the preceding [*V. pubescens*] with which it intergrades."

While it is true that the extreme forms of both species resemble one another to such an extent that the validity of this species

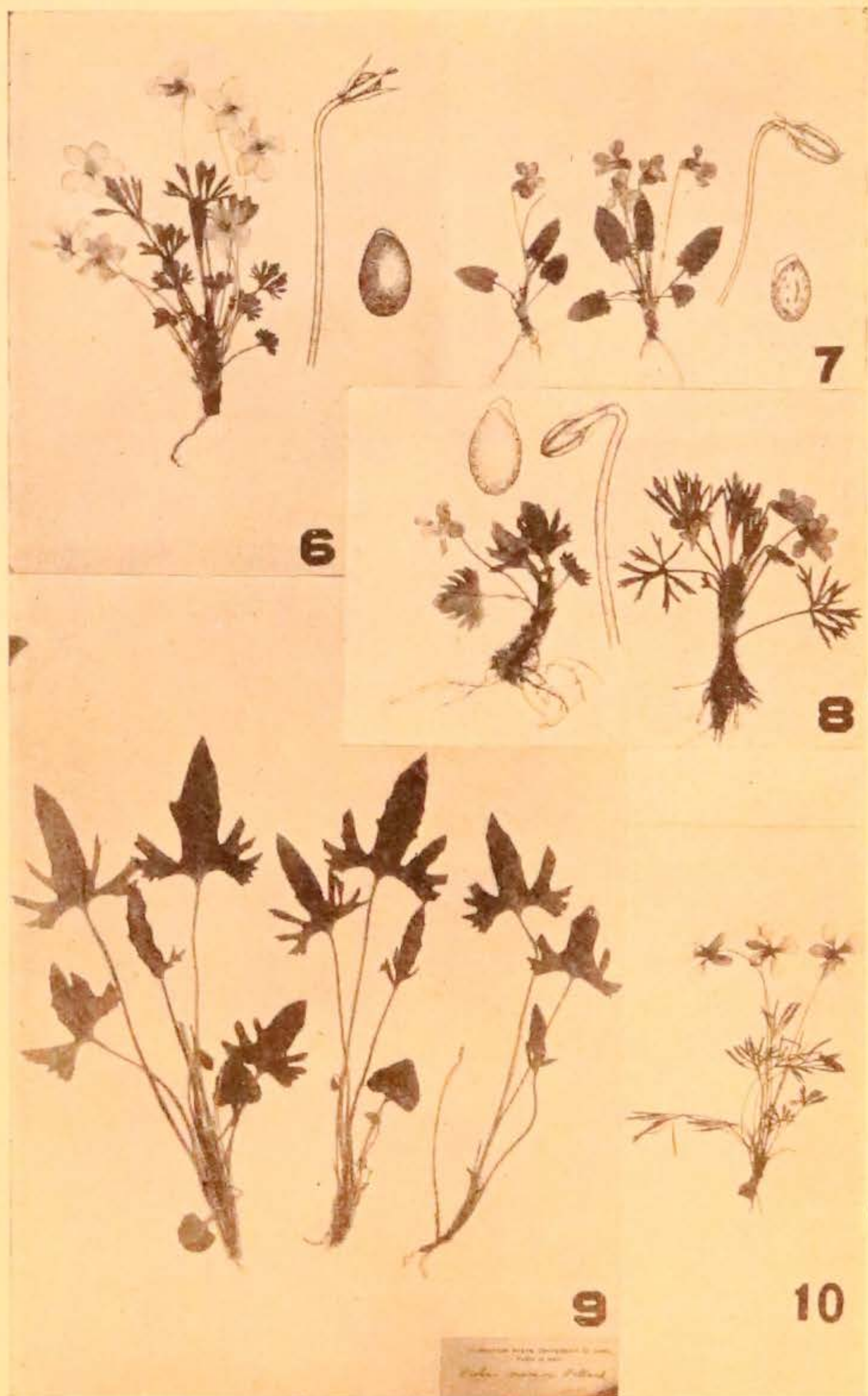


Plate V. Fig. 6, *Viola pedata* var. *lineariloba*; fig. 7, *Viola fimbriatula*; fig. 8, *Viola pedatifida*; fig. 9, *Viola viarum*; fig. 10, *Viola pedata*.

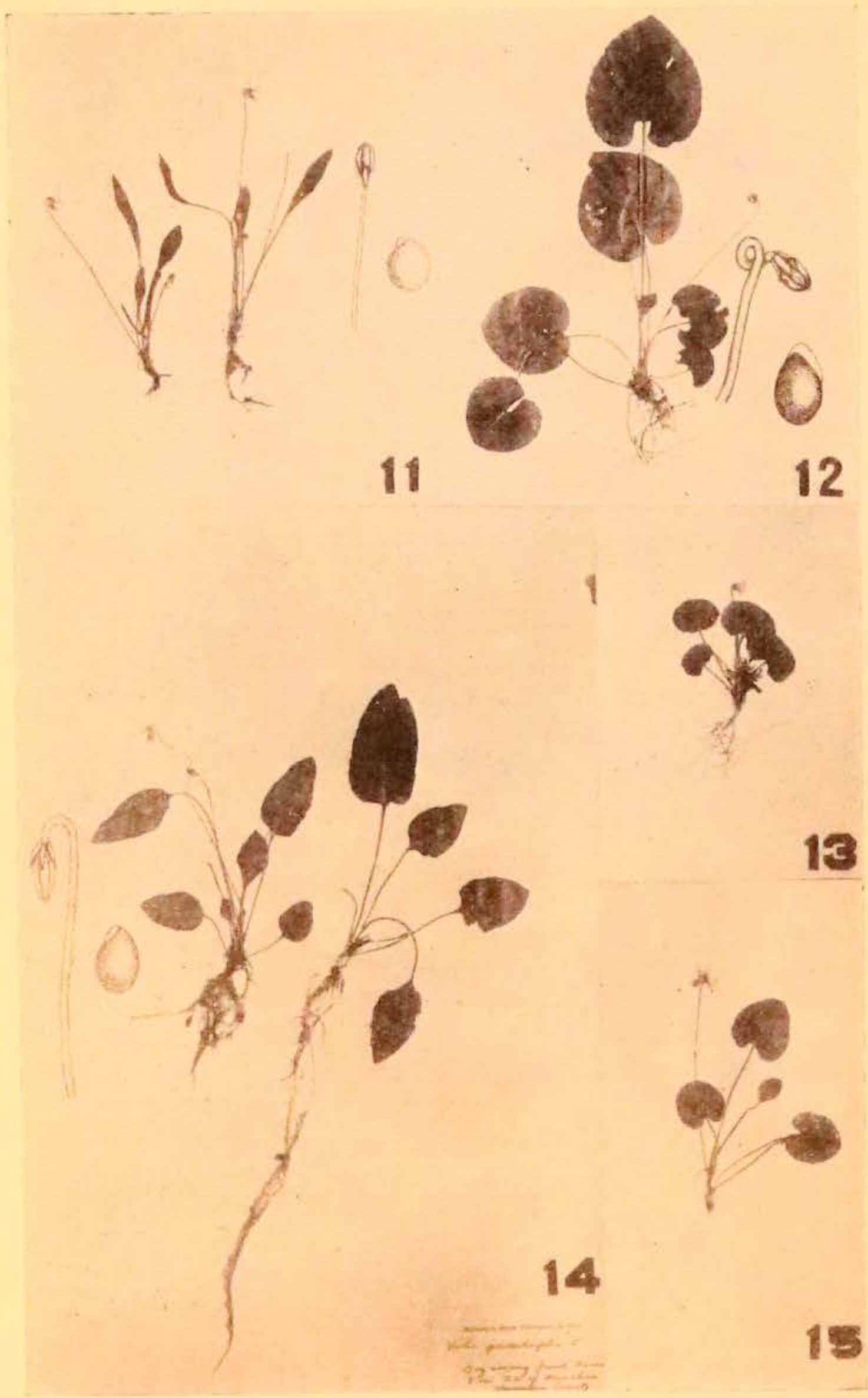


Plate VI. Fig. 11, *Viola lanceolata*, fig. 12, *Viola blanda*; fig. 13, *Viola renifolia*; fig. 14, *Viola primulaefolia*; fig. 15, *Viola pallens*.

Literature Cited

1. Brainerd, Ezra, Violets of North America. Vermont Agr. Exp. Sta. Bulletin 224: 1-72, 75 fig. (25 col.) 1921.
2. Brainerd, Ezra, Notes on New England Violets. Rhodora 6: 8-17. 1904.
3. Britton, N. L. and A. Brown, Illustrated Flora of Northern United States and Canada and the British Possessions. vol. 2. 1897.
4. Britton, N. L. and A. Brown, Illustrated Flora of Northern United States and Canada and the British Possessions. 2 ed. vol. 2. 1913.
5. Gray, Asa, New Manual of Botany. 7 ed. 579-587. 1908.
6. Le Conte, John, Observations on the North American Species of the genus *Viola*. Annals Lyceum Natural History New York. 2: 135-153. 1828.
7. Rydberg, P. A., Flora of the Prairies and Plains of Central North America. 1932.
8. Small, John K., Flora of Southeastern United States. 800-805. 1903.
9. Small, John K. Manual of Southeastern Flora. 1933.

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