

# Violaceae Key

## for *Viola* species in Newfoundland and Labrador

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### Violaceae Family Traits (relative to NL species)

- Plants are **herbaceous**, perennial (in native species), or annual (introduced species).
- Leaves petiolate, stipulate, usually in basal rosettes (in **acaulescent** species) or alternate on erect stems (**caulescent** species). Leaf margins are involute (rolled inward toward the midrib) before expanding.
- Flowers occur in two forms: **chasmogamous** flowers, which have showy petals and are open to cross-pollination, and **cleistogamous** flowers, which lack petals, do not open, and self-fertilize in bud. Chasmogamous flowers are borne on erect peduncles, often taller than the leaves. Cleistogamous flowers are small, sagittate in shape, and usually develop after the chasmogamous flowers; peduncles may be erect or prostrate, the latter arching upward before the capsules dehisce.
- Flowers are axillary, solitary, nodding, 5-merous (floral parts in 5s), and bloom in spring.
- The **calyx** is composed of 5 lanceolate-ovate green sepals, each with a basal lobe, called an auricle. Auricles are usually short, but, in some species, may elongate as the capsules develop.
- The **corolla** is irregular (zygomorphic), with **2 upper petals**, erect to reflexed, **2 lateral petals**, usually spreading, and a **lower spurred petal** with a short or long (4–8 mm) spur projecting backward at the base of the petal. The corolla may be purple to blue or white; also, albino flowers, with white petals, may occur.
- Stamens 5, their anthers connivent (touching, but not fused) around the style; the lower 2 stamens have nectaries at their base that extend into the spur of the lower petal.
- The **ovary** is superior, with 3 carpels, 1 style, and a stigmatic area at the tip of the styles.
- The fruit is a glabrous, 3-valved **capsule**. To disperse seeds, the sides of each valve squeeze together, forcibly ejecting the 0.5-1 mm long, ovoid seeds. Ants, which eat the fleshy caruncle at the base of each seed, disperse the seeds farther.

## Key to the Violaceae in Newfoundland and Labrador

- 1a. Plants stemmed (caulescent), with cauline leaves (and with or without basal leaves); flowers axillary, originating from leaf axils. .... **2**
- 1b. Plants stemless (acaulescent), with basal leaves only; flowers originating from the caudex (top of the rhizome) or axils of basal leaves. .... **4**
- 2a. Plants native, erect to spreading; stipules of cauline leaves narrow, with a few slender teeth to 2 mm long towards the base; petals pale blue to lavender, ± uniform in colour, the spurred petal white at the throat, marked with dark purple veins; spur 4–8 mm long; plants of calcareous or other basic habitats (limestone barrens, basalt outcrops). ..... ***Viola labradorica*** (Labrador violet)
- 2b. Plants introduced, erect; stipules of cauline leaves deeply pinnately or palmately lobed (pinnatisect or palmatisect) at the base; petals bi- or tricolored, with cream, white, yellow, and/or blue or purple, with the lower spurred petal with a yellow or orange throat marked with a few black lines; spur 3–5 mm long; plants of disturbed habitats (lawns, roadsides, abandoned fields, etc.). .... **3**
- 3a. Flowers bicolored, petals cream or white, with the spurred petal darker yellow towards the throat; petals shorter than or barely equal to the sepals; spur 35 mm long. ....  
..... ***Viola arvensis*** (European field pansy)
- 3b. Flowers tricoloured, the upper 2, lateral 2, and spurred petals in various combinations of white, yellow, blue, or purple, the spurred petal yellow or orange towards the throat; petals are much longer than the sepals; spur 4–5 mm long. .... ***Viola tricolor*** (wild pansy)
- 4a. Leaf blades lanceolate, elliptic, oblanceolate, to ovate; leaf bases tapering gradually to the petiole..... **5**
- 4b. Leaf blades ovate to cordate, with cordate leaf bases ..... **6**
- 5a. Leaf blades lanceolate, narrowly elliptic, or oblanceolate, gradually tapering to the petiole (leaf base attenuate); leaf blades 3–8 times as long as broad, to ± 19 cm long by ± 3 cm wide; plants fertile, producing viable seed. ....***Viola lanceolata*** (lanceleaf violet)
- 5b. Leaf blades elliptic, oblong, to ovate, leaf bases abruptly tapering, gradually rounded, or truncate; leaf blades 1.2–2.5 times as long as broad; a sterile hybrid of *Viola lanceolata* and *Viola minuscula*. .... ***Viola ×sublanceolata*** (broad lanceleaf violet)
- 6a. Flowers with white petals. .... **7**
- 6b. Flowers with pale lilac to deep blue-violet petals. .... **9**

- 7a. Leaves glabrous on both surfaces; flowers very fragrant, lateral petals beardless or sparsely bearded with a few hairs; plants of wet, acidic habitats. .... ***Viola minuscula*** (northern white violet)
- 7b. Leaves initially hairy on both surface, mature leaves hairy on either the upper or lower surface; flowers scarcely or not fragrant, lateral petals bearded or beardless; plants of dry to moist forested or barren habitats. .... **8**
- 8a. Plants lacking stolons; mature leaves usually hairy on the upper surface; blades broadly ovate-cordate to reniform; basal lobes of mature leaves parallel to divergent, not overlapping; flowers not fragrant, all petals usually beardless; plants usually growing on limestone or other basic substrates in Nfld. .... ***Viola renifolia*** (kidneyleaf violet)
- 8b. Plants stoloniferous, often forming extensive colonies; mature leaves usually hairy on the lower surface; blades ovate-cordate to broadly cordate; basal lobes of mature leaves slightly divergent to often overlapping; flowers slightly fragrant, the lateral 2 petals bearded; plants of acidic, forested habitats. .... ***Viola incognita*** (largeleaf white violet)
- 9a. Leaves glabrous. .... **10**
- 9b. Leaves hairy on one or both surfaces. .... **12**
- 10a. Plants stoloniferous, often forming extensive colonies; flowers very fragrant; petals pale lilac, mauve, grayish-white, or nearly white, veined with dark purple; lateral 2 petals usually beardless; plants of alpine and northern areas. .... ***Viola palustris*** (northern marsh violet)
- 10b. Plants lacking stolons; flowers not fragrant; petals dark blue-violet; lateral 2 petals densely bearded with straight or clavate hairs; plants of moist to wet low areas in limestone barrens, or in wetlands and shorelines. .... **11**
- 11a. Leaves long than wide; leaf apices acute to narrowly obtuse; lower leaf surfaces green; petaliferous flowers often much taller than the leaves; sepals with prominent, ± 2-lobed auricles, 3–6 mm long; the lateral 2 petals densely bearded with short, clavate hairs; spurred petal beardless; plants of wet marshes, stream banks, and seepage areas. .... ***Viola cucullata*** (marsh blue violet)
- 11b. Leaves about as wide as long; leaf apices obtuse to rounded; lower leaf surfaces often tinged with grey or purple; petaliferous flowers equal to or somewhat taller than the leaves; sepals with short, unlobed auricles, 1–2 mm long; The lateral 2 petals densely bearded with slender straight hairs; spurred petal bearded on the white throat; plants of gravelly calcareous shores and moist areas of limestone barrens. .... ***Viola nephrophylla*** (northern bog violet)

- 12a. Leaf blades hairy above, glabrous beneath; sepals lanceolate, with acuminate to acute apices and entire margins; leaves with basal sinuses deep and nearly closed; inner margins of basal lobes curved inward and often overlapping; spurs elongate, 4–7 mm long; all petals beardless. ....  
..... ***Viola selkirkii*** (great-spurred violet, Selkirk’s violet)
- 12b. Leaf blades hairy on both surfaces, especially when young; flowers with oblong-lanceolate sepals with obtuse to rounded apices and ciliate margins; leaves ± 10 cm long × up to 11 cm wide, basal leaf sinuses open, basal lobes not overlapping; spurs short, to 3 mm long; all petals bearded; lateral petals and spurred petal densely bearded, upper 2 petals with a few scattered hairs. ....  
..... ***Viola septentrionalis*** (northern blue violet)

### Key to *Viola* Comparison Charts

Data and measurements on the comparison charts are based on the references (page 12) and personal observation by the author of live specimens.

- 1a. Plants stemless (acaulescent), flowers arising from the axils of basal leaves. .... **2**
- 1b. Plants stemmed (caulescent), flowers arising from the axils of alternate leaves. ....  
..... **Chart 4** (page 10)
  - 2a. Petals typically white (excluding albino flowers of purple/blue flowers). ....  
..... **Chart 1** (page 5)
  - 2b. Petals of various shades of lilac, lavender, purple, or blue-violet. .... **3**
- 3a. Leaf blades, petioles, and peduncles glabrous..... **Chart 2** (page 7)
- 3b. Leaf blades hairy, at least on one surface. .... **Chart 3** (page 9)

## Viola (Violaceae) Comparison Charts

<b>Viola Chart 1</b> (of 4): <b>Stemless violets with white flowers</b>				
<i>Viola</i> Species:	<b><i>V. incognita</i></b>	<b><i>V. minuscula</i></b>	<b><i>V. renifolia</i></b>	<b><i>V. lanceolata</i></b>
	largeleaf white violet	northern white violet	kidneyleaf violet	lanceleaf violet
<b>Plants</b>	plants colonial, forming extensive carpets; to 14 cm tall; <b>rhizomes horizontal; stolons slender, filiform</b>	plants colonial to 20 cm tall; <b>from a non-creeping rhizome; stolons slender, filiform</b>	<b>plants tufted</b> , to 10 cm tall; rhizome, thick, fleshy; <b>stolons lacking</b>	<b>plants tufted</b> , to 30 cm tall, <b>with slender rhizomes and stolons</b>
<b>Leaf Shape</b>	ovate-cordate to reniform; apex broadly acute, obtuse, to rounded; <b>basal lobes divergent to overlapping at maturity</b> ; margins distinctly crenate	ovate-cordate to ± orbicular or ± reniform; apex acute to rounded, often abruptly apiculate at the tip; basal lobes parallel or divergent; margins shallowly crenate	<b>broadly ovate to ± orbicular or reniform; apex broadly obtuse to rounded</b> , occasionally apiculate; basal lobes parallel to divergent; margins shallowly crenate	<b>elliptic to oblanceolate, gradually tapering to the petiole</b> ; apex acute to obtuse; <b>base cuneate; margins nearly entire, with broad, very flat teeth</b>
<b>Leaf Size</b>	<b>as wide or slightly wider than long</b> ; largest to 6 cm long × 7.2 cm wide	as wide as or longer than wide; mature leaves to ±7.3 cm long × 5.6 cm wide; early leaves 1-3 cm long	<b>as wide or wider than long</b> ; largest to 6.2 cm long × ± 8 cm wide	<b>at least three × as long as wide; largest to 19 cm long × up to ± 3 cm wide</b>
<b>Leaf Surfaces</b>	upper surface usually glabrous; <b>lower surface hairy (hirsute)</b> , paler	<b>glabrous on both surfaces</b> ; lower surface paler	<b>both surfaces initially hairy (hirsute); upper surface hairy (appressed or villous)</b> to glabrate; lower surface glabrate, paler	<b>glabrous on both surfaces</b> ; lower surface paler
<b>Petiole &amp; Peduncles</b>	<b>petioles green</b> , glabrous or hairy (± hirsute); <b>peduncles</b>	<b>petioles green</b> , glabrous or sparsely hairy	<b>petioles and peduncles often red-tinged; densely hairy</b>	<b>petioles and peduncles green, to deep red</b> , glabrous

	<b>often/usually hairy (hirsute)</b>	(hirtellous), with a few long hairs	<b>(villous) when young</b>	
<b>Flowers</b>	to 15 mm long, <b>slightly fragrant</b>	to 12 mm long; <b>very fragrant</b>	to 12 mm long; <b>not fragrant</b>	to 13 mm long
<b>Calyx</b>	sepals lanceolate to lanceolate-ovate, apex narrowly obtuse to rounded, margins entire; auricles short	sepals lanceolate to lanceolate-ovate, apex obtuse to rounded; margins entire; auricles short	sepals lanceolate to lanceolate-ovate, <b>apex acuminate to obtuse; margins entire to finely ciliate</b>	<b>sepals narrowly lanceolate, apex acuminate;</b> margins entire; auricles short
<b>Corolla</b>	white, throat greenish-white, with purple veins			
<b>Upper Petals</b>	upper 2 petals <b>beardless</b>			
<b>Lateral Petals</b>	<b>lateral 2 petals densely bearded</b>	<b>usually beardless;</b> occasionally with a sparse beard of few hairs		
<b>Spurred Petal</b>	<b>beardless,</b> spur short			
<b>Cleistogenes</b>	peduncles prostrate to arching upward, shorter than petioles	<b>peduncles ascending to erect,</b> usually shorter than petioles	peduncles prostrate to arching upward, much shorter than petioles	<b>peduncles erect,</b> reddish-tinged, elongate, shorter than petioles
<b>Capsules</b>	5–9 mm long, <b>green, often with purple blotches</b>	6–7.5 mm long, green, usually unspotted	5–10 mm long, <b>green with purple blotches or capsules purple</b>	4–12 mm long, green, unspotted or with fine red spots
<b>Habitat</b>	acidic, mesic to somewhat wet forests, swamp margins	acidic, wet, mucky or peaty habitats, alder thickets, shorelines	<b>thickets and ravines in limestone barrens, dry to mesic calcareous woods</b>	wet, acidic soils, peatlands or sandy soils

**Note:** *V. ×sublanceolata*, a sterile hybrid of *V. lanceolata* × *V. minuscula*, is most similar to *V. lanceolata*, but has green petioles and its leaf blades are broadly elliptic to broadly lanceolate, with an abruptly tapering or truncate base.

<b>Viola Chart 2 (of 4): Stemless violets with purple or bluish flowers and with glabrous leaves</b>			
<i>Viola</i> Species:	<b><i>V. cucullata</i></b>	<b><i>V. nephrophylla</i></b>	<b><i>V. palustris</i></b>
	marsh blue violet	northern bog violet	alpine marsh violet
<b>Plants</b>	plants tufted, <b>to 26 cm tall</b> ; rhizome thick, stolons lacking	plants tufted, to 16 cm tall; rhizome thick; stolons lacking	<b>plants colonial</b> , to 15 cm tall; <b>rhizome slender, creeping</b> ; <b>stolons slender</b>
<b>Leaves</b>	<b>longer than wide, blades triangular-cordate; apex acute to narrowly obtuse</b> ; basal lobes cordate; margins crenate	<b>as wide as long</b> ; blades ovate-cordate to broadly cordate or reniform; apex obtuse to rounded; basal lobes cordate; margins crenate	<b>longer than wide</b> , blades broadly cordate, reniform, to nearly orbicular; apex $\pm$ obtuse to rounded; basal lobes cordate; margins crenate
<b>Leaf Size</b>	largest to 10 cm long $\times$ up to 6.4 mm wide	largest to 5.2 cm long $\times$ up to 4.9 mm wide	largest to 7 cm long $\times$ up to 4 mm wide
<b>Leaf Surfaces</b>	$\pm$ glabrous on both surfaces, lower surface slightly paler	$\pm$ glabrous on both surfaces; <b>lower surface often greyish- or purple-tinged</b>	glabrous on both surfaces
<b>Petioles &amp; Peduncles</b>	green, glabrous; peduncles much taller than the leaves	green, glabrous; peduncles taller than the leaves	grey-green, glabrous; peduncles equal to or taller than the leaves
<b>Chasmogamous Flowers</b>	to 23 mm long, not fragrant	to 18 mm long; not fragrant	to $\leq$ 16 mm long; <b>very fragrant</b>
<b>Calyx</b>	sepals lanceolate, <b>acute to acuminate</b> ; margins entire to <b>finely ciliate</b> ; auricles prominent in fruit	sepals lanceolate-ovate, <b>obtuse to rounded</b> ; margins entire; auricles short	sepals lanceolate-ovate, acute to obtuse; margins entire; auricles short
<b>Corolla</b>	pale blue to deep blue-violet, <b>often darker around the white throat</b> ; with dark blue veins	blue-violet to deep blue- violet, throat white, with dark blue veins	<b>lilac, mauve, to greyish- white</b> , throat greenish-white; with dark purple veins
<b>Upper Petals</b>	upper 2 petals beardless		
<b>Lateral Petals</b>	<b>lateral 2 petals densely bearded with short clavate or round-tipped hairs.</b>	<b>lateral 2 petals densely bearded with slender, straight hairs.</b>	<b>lateral 2 petals usually beardless to slightly bearded</b>

<b>Spurred Petal</b>	spurred petal beardless; spur short, rounded	<b>spurred petal bearded (villous) at the base</b> ; spur short, rounded	spurred petal beardless; spur short, rounded
<b>Cleistogamous Flowers</b>	peduncles ascending; slightly shorter or longer than the petioles	peduncles recurved or ascending, shorter than the petioles	peduncles ascending or erect, shorter or longer than the petioles
<b>Capsules</b>	10–15 mm long, green, unspotted	7–10 mm long, green, unspotted	5–8 mm long, green, usually unspotted
<b>Habitat</b>	streambanks, marshes, acidic sedge meadows	limestone barrens, sedge meadows, fens, basalt or calcareous rocky shores	alpine to subalpine wet meadows, shores, often on calcareous substrates

**Note:** *Viola* × *melissifolia*, a sterile hybrid of *V. cucullata* × *V. septentrionalis*, has only been collected once in Nfld. (specimen at MT); it exhibits morphological traits intermediate between the two parents.



<b>Viola Chart 3</b> (of 4): <b>Stemless violets with purple or bluish flowers and hairy leaves</b>		
<b>Viola</b> Species:	<b><i>V. selkirkii</i></b>	<b><i>V. septentrionalis</i></b>
	Selkirk's violet, great spurred violet	northern blue violet
<b>Plants</b>	plants tufted, to 10 cm tall; rhizome thick; <b>seldom with stolons</b>	plants tufted, to 29 cm tall; rhizome thick; <b>stolons lacking</b>
<b>Leaves</b>	blades ovate-cordate to ± reniform; apex sharply obtuse to apiculate; <b>inner margins of deep basal lobes curve inward, often touching or overlapping; margins prominently crenate, often undulate</b>	blades narrowly to broadly ovate-cordate, becoming deltate-reniform in fruit; apex obtuse to rounded; <b>basal lobes divergent, not curving inward at maturity</b> ; margins crenate
<b>Leaf Size</b>	slightly longer than wide; <b>largest leaves to 5 cm long × 4.5 cm wide</b>	slightly longer than wide; <b>largest leaves to 9.8 cm long × ± 9 cm wide</b>
<b>Leaf Surfaces</b>	<b>upper surface of blades hairy (strigose); lower surface glabrous</b>	<b>leaf blades hairy (hirsute) on both upper and lower surfaces; lower surface often purple-tinged</b>
<b>Petioles &amp; Peduncles</b>	<b>green or tinged with reddish-brown, glabrous</b>	mostly green, petiole bases often purple; <b>hairy (hirsute)</b>
<b>Flowers</b>	to 1.5 cm long, not fragrant	to 2.2 cm long; not fragrant
<b>Calyx</b>	sepals lanceolate, <b>often tinged with red, apex acuminate to acute</b> ; margins entire; auricles prominent, with 2 short, angular lobes, glabrous, not elongating in fruit	sepals oblong-lanceolate, green, <b>apex obtuse to rounded; margins ciliate ± to the apex</b> ; the prominent auricles ciliate, <b>in fruit, elongating to 1.5-3 mm long</b>
<b>Corolla</b>	<b>lavender to purple</b> , throat white, veined with dark purple	<b>pale lilac to deep blue-violet</b> ; throat white, veined with dark blue-violet
<b>Upper and Lateral Petals</b>	<b>all petals beardless</b>	<b>upper 2 petals with a few hairs at the base; lateral 2 petals densely bearded</b>
<b>Spurred Petal</b>	beardless; <b>spur long, 4–7 mm long</b>	<b>bearded at base, spur short, ≥ 3 mm long</b>
<b>Cleistogenes</b>	on short, prostrate to arching peduncles	
<b>Capsules</b>	capsules green, often purple-mottled; 4–8 mm long	capsules green or purplish, purple-mottled; 5–8 mm long
<b>Habitat</b>	<b>rich deciduous or mixed-wood forests, on calcareous substrates</b>	<b>open, dry to mesic forests, often coniferous</b> , clearings, alluvial thickets

<b>Viola Chart 4</b> (of 4): <b>Stemmed violets</b>			
Species:	<b><i>Viola labradorica</i></b>	<b><i>Viola arvensis</i></b>	<b><i>Viola tricolor</i></b>
	Labrador violet	field pansy	Johnny-jump-up
<b>Plants</b>	<b>perennials</b> , rhizome slender, <b>stems creeping or spreading, to 2.5 dm long, ascending at the tips</b>	<b>annuals</b> , from a taproot; stems erect, to $\pm$ 4 dm tall; stems glabrous or finely hairy (hirtellous)	<b>annuals</b> , from a taproot, stems $\pm$ erect, to 4.5 dm tall; stems 4-angled, finely hairy (puberulent) on the angles
<b>Leaves</b>	cauline and basal leaves present; blades ovate to broadly cordate, yellow-green to deep green; apex broadly acute to rounded or apiculate; base shallow to deeply cordate, margins crenate, with low, flat teeth	cauline and basal leaves present; <b>cauline leaves</b> narrowly elliptic to lanceolate, tapering to the base, apex obtuse to rounded; <b>basal leaves</b> lanceolate to ovate, apex obtuse to rounded, base broadly cuneate to truncate; margins crenate	leaves cauline; <b>upper leaves</b> narrowly elliptic to lanceolate, tapering to the cuneate to rounded base; apex mostly rounded; margins crenate; <b>lower leaves</b> smaller and often wider than upper leaves
<b>Leaf Size</b>	<b>about equal in length and width; largest to <math>\pm</math> 3 cm long and wide</b>	upper leaves to 3.3 cm long $\times$ 1 cm wide; lower leaves to $\pm$ 2 cm long $\times$ 1.6 mm wide	upper leaves to 3.8 cm long $\times$ 1 cm wide; lower leaves to $\pm$ 1.6 cm long $\times$ 1.5 mm wide
<b>Leaf Surfaces</b>	<b>usually glabrous</b> ; occasionally, upper surface with short appressed hairs	<b>finely hairy (hirtellous) on both surfaces</b>	
<b>Stipules</b>	<b>lanceolate, margins incised</b> , with few to several long, slender teeth to 2 mm long on each margin	<b>deeply pinnately divided</b> below the oblanceolate terminal lobe, with entire to crenate margins	<b>deeply pinnately or palmately lobed</b> below the terminal elliptic to narrowly oblanceolate lobe, with crenate margins
<b>Petioles &amp; Peduncles</b>	green, <b>glabrous</b>	green, glabrous or finely hairy (hirtellous)	green, usually glabrous, or finely hairy (hirtellous)
<b>Flowers</b>	to 17 mm long; petals longer than the sepals	to 19.5 mm long, <b>petals usually shorter than the sepals</b>	to 18 mm long, petals longer than the sepals

<b>Calyx</b>	narrowly lanceolate, apex acuminate, <b>surface glabrous, margins entire; auricles short</b>	lanceolate, apex acuminate, surface finely hairy (hirtellous), margins ciliate; <b>auricles prominent, broad</b>	triangular-lanceolate, apex acuminate, surface finely hairy (hirtellous), margins ciliate; <b>auricles prominent, with 2-3 shallow pointed lobes</b>
<b>Corolla</b>	<b>pale blue, periwinkle blue, to lavender, throat white</b>	upper 2 and lateral 2 petals usually white to cream; occasionally purple; <b>lower petal yellow, throat darker yellow; with a few black lines at the base of lateral and spurred petals</b>	<b>petals usually tri-coloured, occasionally all similar in colour;</b> petals may be white, yellow, blue, or purple; throat yellow or orange, with a few slender black lines at the base of lateral and spurred petals
<b>Upper Petals</b>	upper 2 petals beardless		
<b>Lateral Petals</b>	lateral 2 petals densely bearded with slender hairs	<b>lateral 2 petals densely bearded with slightly thickened hairs</b>	lateral 2 petals densely bearded with slender hairs
<b>Spurred Petal</b>	spurred petal beardless, <b>spur 4–8 mm long</b>	spurred petal beardless, spur 3–5 mm long	spurred petal beardless, spur 4–5 mm long
<b>Cleistogenes</b>	<b>in axils of upper leaves</b>	<b>lacking</b>	
<b>Capsules</b>	<b>3–6 mm long</b> , green, unspotted or with fine red markings	5–10 mm long, green, unspotted	6–10 mm long, green, unspotted
<b>Habitat</b>	<b>native species; barrens on limestone and other basic rocks; fens, and rich meadows</b>	<b>introduced</b> in NL; occasionally found in disturbed areas	

## References:

For full descriptions of the *Viola* species, I recommend you visit Dr. Ballard's excellent website on eastern North American violets:

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