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## The Nature of *Viola missouriensis* Greene

By NORMAN H. RUSSELL<sup>1</sup>

One of the most distinctive of the stemless blue violets of the upper midwest is *Viola missouriensis* Greene, the Missouri Violet. It is one of the approximately twenty-eight species of the Subsection *Boreali-Americanae*, Section *Nominium*, a group of violets somewhat notorious for their propensity for interspecific hybridization. Population studies were initiated in 1956 to define the members of this group more accurately and to determine the effect of hybridization upon their taxonomy and evolution. The Subsection *Boreali-Americanae* includes the so-called "stemless" (acaulescent), blue-flowered species. Within this group of species, two types of violets can be roughly distinguished: the entire-leaved species and the species with lobed or dissected leaves. As will be seen below, this distinction is not a good taxonomic one, though it is convenient for purposes of discussion.

There are three entire-leaved species in the midwest: *V. papilionacea* (Russell and Graham, 1958), *V. sororia* (to be discussed in a later paper), and *V. missouriensis*. *Viola sororia* is by far the most abundant and the most variable of the three species. Perhaps its most characteristic morphological feature is the pubescence of the leaves and other parts of the plant. Both *V. papilionacea* and *V. missouriensis* are, in the genetically pure condition, completely glabrous. Occasionally plants of *V. missouriensis* may have a few tiny hairs on the upper lobes of the laminae. *V. missouriensis* is most easily separated from these two relatives by the shape of the mature leaf in summer. The leaf blade is either sharply or bluntly attenuate (Fig. 1), and, most important, the margins of the apical portion have usually only 1-3 teeth (crenations), as contrasted with the apical margins of the leaves of *V. papilionacea* and *V. sororia*, which have, in the same area, 8 to 10 or more teeth.

During the summers of 1956 and 1957 fourteen population samples of *V. missouriensis* were obtained in the midwest. The locations of these samples are shown in Figure 2. When possible fifty plants were sampled, but occasionally the populations were too small to permit this. A single mature leaf was taken from each plant, pressed and dried, and eventually studied. The measurements and observations made are summarized in Table 1. Lamina length along

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the midrib, lamina breadth at the widest point, and the length from the lamina apex to one of the basal lobes were used in preparing the length/breadth and length/length to lobe ratios. The apical angle measured was one from the horizontal to the apical leaf margin. In addition the number of crenations along half the leaf margin was counted, and leaf pubescence was scored for four areas: the upper and lower surfaces of the lamina, the lamina margin, and the petiole. In all four areas, a score of zero indicated complete glabrousness, a score of 1 indicated a few hairs on the veins, of 2, hairs in addition on some inter-vein areas, and of 3, hairs completely over the leaf surface.

Genetically pure populations of *V. missouriensis* are, in the author's opinion, non-existent or at least extremely rare in the midwest.

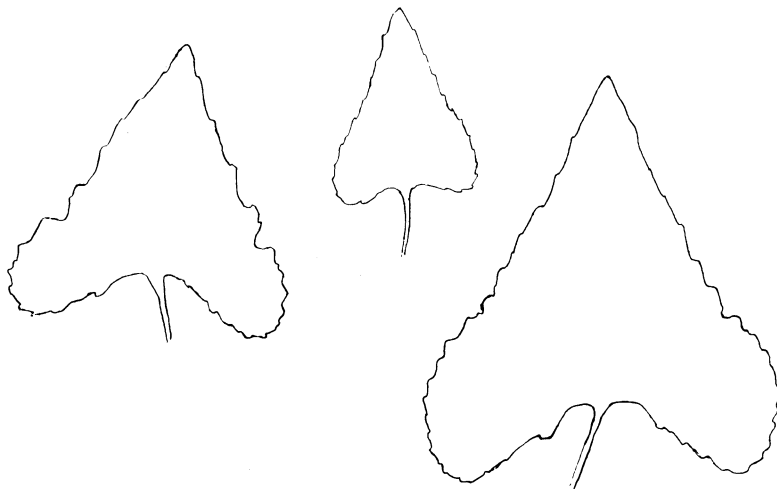


Figure 1. Sketch of the leaf outlines of typical leaves of *Viola missouriensis*.

None were encountered in the present study. Every population sampled showed the effects of hybridization with other stemless blue violets, principally *V. sororia* Willd. In every population completely glabrous plants with leaves longer than broad, short basal lobes, attenuate, sparsely-toothed apices, and narrow apical angles were present, but in addition many other plants varying toward *V. sororia* were also present. Most of the time *V. sororia* grew in the same woodland, or in adjacent woodlands and sometimes, in ecotonal areas, plants of the two species grew together, and all degrees of putative hybridization could be located. In Table 1, the extent of introgression is roughly indicated by the difference of each population from 56-15, the first listed. In the case of a population such as 57-18 or 57-3, introgression from *V. sororia* was very great.

Additional studies of *V. missouriensis* from other states have been made and tend to verify the above conclusions. Measurements of specimens from the herbaria of the University of Tennessee and the University of Minnesota are given in Table 2. Interestingly enough, few of the intermediate specimens, so common in nature, find their way into herbaria, so that herbarium specimens may give a better picture of "pure" species morphology than is at first evident in nature. Unquestionably this is because most field taxonomists avoid collecting intermediate or difficult specimens. Consequently, even

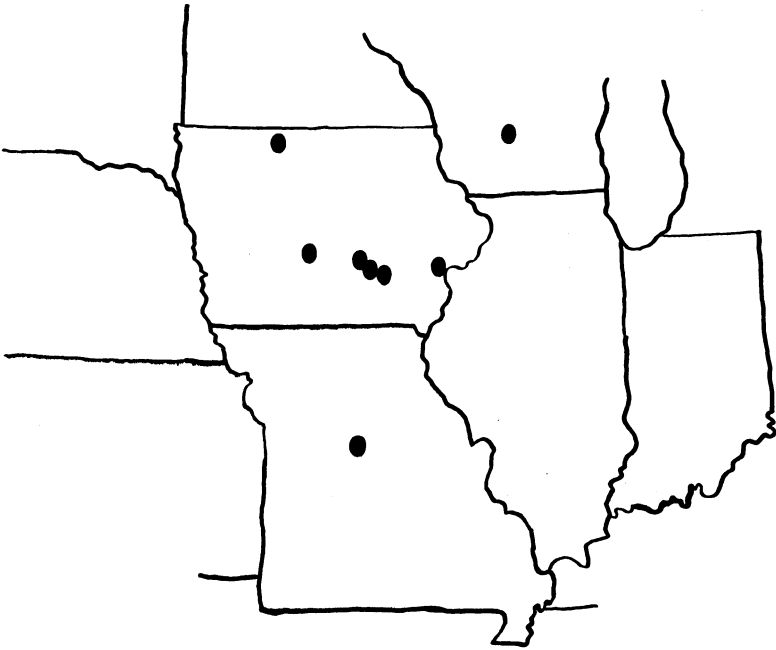


Figure 2. Locations of population samples of *Viola missouriensis*.

though the species themselves are accurately indicated by herbarium specimens, actual genetic situations in nature may be obscured.

*Viola missouriensis* was found, during the field studies, in two principal locations. Most commonly, it grows on alluvial soil in river forest dominated by elm and silver maple. Here it occurs primarily on level land under a fairly heavy shade cover. *V. sororia*, when it grows in these situations, is on higher ridges or on better-drained slopes. A second location for *V. missouriensis* is in moist, shaded locations in towns and cities, where it may come in contact with both *V. sororia* and *V. papilionacea*.

Table 1

A Summary of the Characteristics of Fourteen Populations of *Viola missouriensis*

Sample Number	No. Spec.	Lamina length	L/b ratio	L/11 ratio	Apical angle	Number teeth	above	below	Pubescence margin	petiole	Total Pubesc.
56-15	50	51.94mm	1.00	0.79	61.82°	17.10	0.04	0.06	0.22	0.02	0.34
56-58	50	51.84	0.87	0.70	52.48	20.02	0.92	0.40	0.34	0.10	1.76
56-75	50	44.28	0.89	0.77	59.30	17.76	0.14	0.00	0.02	0.00	0.16
56-79	39	64.43	0.86	0.76	57.17	20.41	0.82	0.85	0.33	0.15	2.15
56-95	45	76.60	0.91	0.75	53.04	23.57	0.02	0.60	0.07	0.71	1.40
56-102	50	74.20	0.94	0.76	56.60	22.10	0.14	0.32	0.28	0.32	1.06
56-116	50	74.40	0.87	0.76	51.24	26.06	0.04	0.50	0.22	0.42	1.18
56-120	50	60.60	0.96	0.76	57.94	23.30	0.02	0.00	0.22	0.00	0.24
57-3	37	63.38	0.82	0.76	49.48	30.38	0.14	0.78	0.46	0.70	2.08
57-10	37	60.18	0.82	0.77	54.18	26.21	0.14	0.08	0.32	0.03	0.57
57-18	40	64.45	0.85	0.75	56.90	23.70	0.73	0.98	0.48	0.33	2.52
56-26	28	47.25	0.94	0.77	55.21	20.67	0.79	0.04	0.71	0.04	1.58
56-32	50	55.50	0.97	0.78	59.50	20.04	0.14	0.00	0.04	0.00	0.18
56-39	39	71.21	0.84	0.78	52.87	24.94	0.87	0.46	0.36	0.41	2.10

VIOLA MISSOURIENSIS

Table 2

A Summary of the Characteristics of Specimens of *Viola missouriensis*  
from Tennessee and Minnesota

Characteristic	Tennessee	Minnesota
Number of specimens	12	9
Lamina length		44.66 mm
L/b ratio	0.99	1.03
L/11 ratio	0.81	0.84
Apical angle	75.66°	75.00°
Pubescence		
Above	0.25	0.11
Below	0.00	0.00
Margin		0.00
Petiole		0.00
Number of teeth	18.33	19.00
Petal pubescence <sup>1</sup>	0.30	0.11

<sup>1</sup>glabrous—0, few hairs—1, very pubescent—2

#### TAXONOMIC STATUS

During the examination of specimens from a number of major herbaria, as well as in the field investigations, it has become apparent that *V. missouriensis* is very similar to both *Viola affinis* LeConte, an essentially eastern violet, and *V. viarum* Pollard, a relatively local midwestern form. The separation into three different species seems to rest upon the difference in leaf shape between *V. viarum*, a violet with 3-5 conspicuous basal leaf lobes and the other two species which have (supposedly) entire leaves, and between the erect cleistogenes of *V. affinis* and the (supposedly) prostrate cleistogenes of *V. missouriensis*. These "differences" are either exaggerated or not at all true. The summer cleistogenes of *V. missouriensis* are on erect or at least ascending peduncles, and therefore are very nearly identical to those of *V. affinis*. Farther to the west *V. missouriensis* grades into *Viola viarum* also in leaf shape. Many specimens of *V. missouriensis* collected by the author and seen in herbaria had summer leaves with shallow basal incisions, and, on the other hand, specimens of *Viola viarum* frequently had some entire leaves or the mature leaves only shallowly incised.

In flower characteristics *V. missouriensis* is said to have glabrous spur petals, while those of *V. affinis* are heavily pubescent. In this characteristic also, there is some gradation, as even populations of *V. missouriensis* in the midwest and elsewhere always have some plants with light petal beards. Petal color (pattern) differs between these two "species," *V. missouriensis* having light lavender corollas and *V. affinis* darker violet petals.

Geographic ranges of the three entities show considerable overlap but do form, roughly, an east-west sequence. *Viola viarum*, the

western-most, is found, according to Fernald (1950), in Iowa, Missouri, Kansas and Oklahoma. *Viola missouriensis* grows from Indiana to Iowa and Nebraska, south to Kentucky, Arkansas and Tennessee, and *V. affinis* occurs from southwestern Quebec and Vermont to Wisconsin, south to southern New England, Georgia, Alabama, Tennessee, and Arkansas.

In view of the above, it appears that *V. missouriensis* is part of a species complex consisting of at least three entities, probably best considered subspecific. *Viola affinis*, named by LeConte in 1826, would take precedence over *V. missouriensis* (1900) and *V. viarum* (1901) as the specific name for the group. These nomenclatural changes will be proposed in another journal.

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