

## VARIATION IN FLOWER COLOR IN HAMAMELIS VERNALIS

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*With one text figure*

WHATEVER the ultimate explanation, there seem to be certain species of plants in which the variation between one individual and another is unusually marked. *Hamamelis vernalis* is such a species, for the plants of a single locality vary markedly in flower color, color pattern, time of blooming, and the number and arrangement of the flowers on the flowering branches. In this respect the species stands in sharp contrast to *H. virginiana* which, though it runs into geographical varieties, is comparatively uniform in any one locality. In *Hamamelis virginiana*, variation in flower color, while not unknown, is extremely rare. Examination of many individuals in eastern Massachusetts has revealed only two with a faint flush of red at the base of the petals. At Sterling, Massachusetts, for instance, of 35 individuals examined, 34 were pure yellow and one was flushed with red on the calyx and at the base of the petals. There is at the Arnold Arboretum a bush presumably collected in eastern Massachusetts which has light red petals and a yellowish green calyx (Rehder, 1922). A similar bush was collected some years ago near Malden, Massachusetts, by Mr. Edward L. Rand (Sargent, 1893). Mr. O. A. Farwell has collected a similar form with red calyx lobes at Stony Creek, Michigan and it has been distributed as Farwell, no. 3943. Variation in flower color is therefore not unknown in *H. virginiana*, though it is comparatively infrequent.

In *H. vernalis* nearly every bush has its own distinctive flower color and it is not at all uncommon to find pure yellow-flowered plants growing side by side with red-flowered ones. These differences seem to be germinal, since there is little variation between the flowers on a single bush and since the peculiarities of a particular bush persist after transplantation. The specimens in the living collections of the Arnold Arboretum maintain their characteristic flower colors season after season and the colors are perpetuated in plants propagated vegetatively. One color form has already received taxonomic recognition, *Hamamelis vernalis* forma *carnea* Rehd.

The following records of variation in natural populations of *H. vernalis* (Tables 1 & 2) were made in St. Francis County, Missouri, on February 28, 1931. In each case the bushes, as is usual in this species, were growing in gravelly creek beds. At each locality, for a distance of



approximately one-eighth of a mile along the watercourse, a single representative twig was taken from each bush then in flower. The specimens were then taken to the laboratory and a record was made of their color and color pattern. The underlying yellow pigment seems to be practically the same shade throughout all the plants and nearly all of the variation in color is due to variations in the intensity and distribution of the red pigment, which was found to be a water soluble substance occurring in the epidermis of the petals and sepals. In the petals it varies from none at all, to a faint flush at the base, through intermediate stages up to 85% of the length. In their general tone the flowers varied from Light Cadmium Yellow (Ridgway) to Dragon's Blood Red (Ridgway). The coloring always extends up from the base of the petals and even the reddest flowers were yellow at the very tips of the petals. On the sepals the color seems to spread from the mid-vein. In the following records it has been summarized under four grades:

- |                   |  |
|-------------------|--|
| "pure yellow."    | no red pigment in the sepal.   |
| "line plus."      | sepal red along the mid-vein with a faint flush of red at either side. |
| "all but margin." | sepal red with a narrow yellow margin at either side.                  |
| "entire."         | red pigment distributed over the entire sepal.                         |

It will be seen that while the variation at the two localities was similar, that the colors were on the average a little darker at Flat River than at Libertyville. While the intensity of the red coloring on the petals was associated with the coloring of the sepal, the correlation was not perfect. This is shown graphically in Table 2 which summarizes the data from both localities.

The above tables present a graphic and objective summary of variation in color pattern. The size and development of the flowering branches seem to be quite as variable, though it is difficult to record the variation objectively. My colleague, Mr. Ernest J. Palmer, tells me that there is a correspondingly great variation in the degree of pubescence of the leaves. This has been given varietal recognition in *H. vernalis* var. *tomentella* (Rehd.) E. J. Palmer.

It is particularly interesting to find such variation in *H. vernalis* since it is a species of very limited distribution, being known only from the Ozark Mountains and adjacent lowlands to the south and west. It may well be an ancient species like many others in that area (Palmer and Steyermark, in press), since its closest affinities are with the Asiatic species of *Hamamelis* rather than with the American *H. virginiana*. Like them it is winter-flowering, like them it has an extensive develop-

ment of red pigment in the flower, like some of them it has a tendency to pubescent leaves. The genus is known from its fossil record (Berry, 1916) to be an ancient one which was formerly wide-spread in the northern hemisphere.

It is commonly said that species of limited distribution are less variable than those more widely distributed. As far as *Hamamelis vernalis* and *H. virginiana* are concerned the reverse seems to be true. The approximate ranges of the two species are shown in Figure 1. *Hamamelis virginiana* covers an area many times as large as that of *H. vernalis* and yet in any one locality the variation in color, habit, and pubescence is much less. It is of course quite possible that variability

TABLE 1. Variation in petal color and sepal color of 63 plants of *Hamamelis vernalis* examined at Libertyville and Flat River, Missouri. Further explanation in the text.

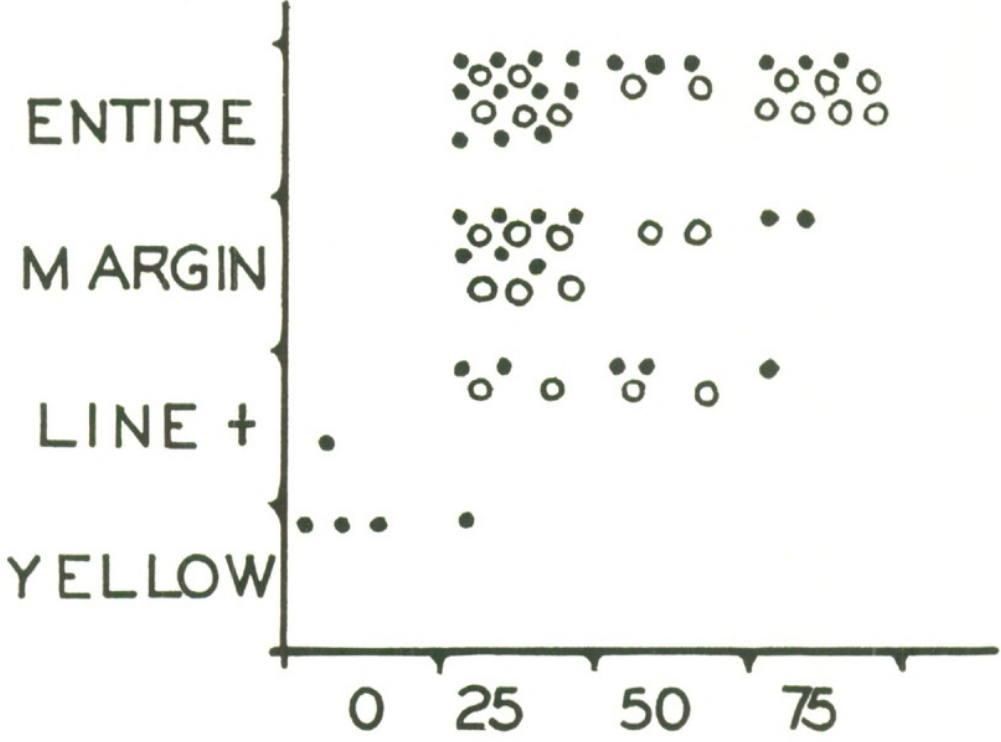
Libertyville, Missouri			
% of petal red	distribution of red in calyx	% of petal red	distribution of red in calyx
0	pure yellow, flush of red at petal base	50	line plus
25	line plus	50	entire, faint
75	entire	25	entire, faint
25	entire, faint	25	entire
50	entire, faint	25	entire
25	all but margin	75	all but margin
0	line plus	25	entire, faint
25	entire, faint	25	all but margin
50	entire, dark	25	entire
25	entire, faint	25	pure yellow
25	entire	25	entire
0	pure yellow, pure lemon yellow	25	entire
75	entire	25	entire
75	line plus	25	all but margin, faint
0	faint flush, flush at petal base	25	all but margin, faint
75	entire	50	line plus
25	line plus	75	all but margin
25	all but margin	25	all but margin



TABLE I (Continued)  
Flat River, Missouri

% of petal red	distribution of red in calyx	% of petal red	distribution of red in calyx
50	line plus	25	all but margin
25	entire	75	dark, all but margin
25	line plus	50	all but margin
25	all but margin	25	all but margin
75	entire	75	entire
25	all but margin	50	entire
25	line plus	50	entire
25	entire	75	entire
25	entire, dark	75	entire, dark
50	all but margin	75	entire
25	entire, faint	75	entire
25	entire, faint	75	entire
25	all but margin	50	line plus
25	all but margin		

TABLE 2. Correlation in petal color (vertical scale) and sepal color (horizontal scale). Each dot represents the combination found in a single individual. Solid dots, Libertyville; open circles, Flat River.



between plants in any one locality and variation between one region and another are quite different processes. As far as *inter-regional* variation is concerned *H. virginiana* is perhaps quite as variable as *H. vernalis*.

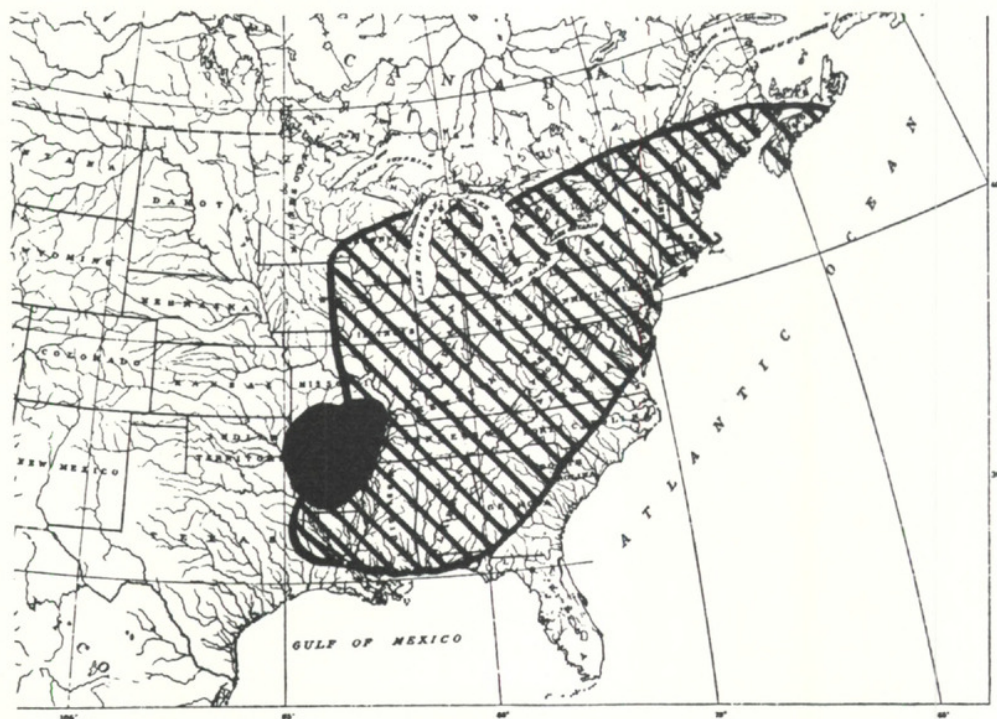


FIGURE 1. Approximate distribution of *Hamamelis vernalis* (solid black) and *Hamamelis virginiana* (diagonal lines).

### SUMMARY

*Hamamelis vernalis*, a species of very limited distribution, is shown to exhibit a high degree of *intra-regional* variability.

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