Journal of the Minnesota Academy of Science

Volume 9 | Number 1 Article 4

4-1941

Abstract Papers

of the moccasin, and ankle thongs are attached to securely bind the flaps. Covering the vamp is a piece of deerskin embroidered with intricate floral designs in silk, or more commonly with beadwork since silk is quite expensive and more difficult to use. However, beadwork designs, in general, follow the same outline as those embroidered in silk. The oval vamp is bordered with several lines of silk-wrapped horsehair, within which lies a wide margin of colored beadwork arranged in two rows of interlocking triangles and a central U-shaped block of floral patterns or geometrical designs on a white background. Individual variations within this essential outline, including diamonds, squares, bars, triangles, and crosses as well as a variety of leaf and flower forms, are too numerous to be classified.

The winter type, or "mitt-moccasin", has a larger vamp, no seam over the toe, and usually no design as beadwork would be easily destroyed by the constant wear of the snowshoe strap. Children's moccasins with simple beaded designs sewed on by young girls are generally of this type. As dressed mooseskin is not waterproof, moccasin rubbers without heels are bought from the trader's stock and are worn continuously throughout the summer. Rubbers are discarded in winter, however, as the dry snow does not penetrate the moccasins.

THE COLORS OF BEARDED IRISES

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ABSTRACT

Chemical experiments have been carried out in order to find out why bearded irises have such a wide variety of colors. Fifty-seven varieties of iris were analyzed in order to determine what pigments and what precursors of the anthocyanins were present. The results of these analyses lead to several interesting conclusions which are enumerated below.

1. Flavonol and anthocyanin are two possible precursors of the anthocyanins. Only small amounts of the former, and none of the latter, were found.

2. Yellow and white irises fail to produce anthocyanin colors for two distinct reasons. In some of these irises the mechanism for the transformation of the chromogen into the pigment is lacking. In others the chromogen → pigment transformation takes place, but the pigment exists as colorless pseudobase.

3. Some of the well-known colors of irises, such as tan and brick red, are due to anthocyanin underlaid by yellow plastid pigment. Other colors, such as blue, are due entirely to anthocyanin, no plastid pigment being present.

ANTHOCYANIN DEVELOPMENT IN PLANTS IN RELATION TO SOIL NITROGEN

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ABSTRACT

Ammonium nitrate has been applied over a period of several months to the soil in which several species of plants were growing and the differences in the amounts of pigments produced have been observed. It was found that the blooms of African Violet, Browallia, Geranium, and Wandering Jew growing in the fertilized soil produced more anthocyanin than those growing in the unfertilized soil. The foliage of Wandering Jew, several plants of the genus *Coleus*, and the roots of radish plants produced more anthocyanin in the high than in the low nitrogen soil. The foliage and petioles of *Begonia metallica* and African Violet produced more anthocyanin in the unfertilized soil. The data obtained indicate that in those parts of the plant where available nitrogen increases the amount of chlorophyll it decreases or does not alter the amount of anthocyanin. In the parts of the plant where the amount of chlorophyll is not markedly changed by application of ammonium nitrate to the soil, the amount of anthocyanin appears to be increased by the nitrogen.

In the plants studied, plastid pigments were not found in the anthocyanin producing parts under any conditions. Flavonol, a possible precursor of the anthocyanin, was found in all of the plants and the amount was not affected by the fertilizer. Some *Coleus* plants were found to contain very little chlorophyll.

OBSERVATIONS ON THE AUTUMN COLORS OF MAPLE TREES

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ABSTRACT

In the late summer, before the frosts, it is frequently noticed that the leaves of some hard maple trees show marked amounts of autumn coloration, while the leaves of others, growing within a few feet, are almost wholly green. This phenomenon occurs widely, having been observed in hard maples from Niagara Falls across lower Ontario and Michigan and in Minnesota.

The causes of the phenomenon have been investigated in Northfield. It is commonly believed that this early autumn coloration is

due to one or more of the following causes: low soil moisture; low soil fertility; poor aeration of the soil; the age and lack of vigor of the tree. Tests and observations reveal that these explanations are apt to be erroneous.

The present studies indicate that there are two reasons for the early formation of autumn coloration in these maples. Detailed examination reveals that many of the early turning trees appear to be *Acer nigrum* rather than *Acer saccharum*. Taxonomically *A. nigrum* and *A. saccharum* intergrade and easily may be mistaken for one another. The data seem to show that *A. nigrum* exhibits autumn colors earlier than *A. saccharum*. Thus we have differences between species. Another cause of the phenomenon appears in that there seems to be a great deal of variability within the *saccharum* species with respect to time of appearance of autumn colors. *A. nigrum* appears to be less variable in this respect than *A. saccharum*.

DEMONSTRATION OF THE ELECTRON MICROSCOPE

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THE POPULATION OF MINNESOTA IN 1940

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Biological Science

THE RATE OF ANGLING AND ITS EFFECT ON THE FISH POPULATIONS OF SOME NORTHERN MINNESOTA LAKES

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ABSTRACT

1. Creel censuses were made on all fishes caught during the summer of 1940, from five northern Minnesota lakes, determining the kinds and numbers caught.
2. The total poundage and rate of catch were determined for each lake.
3. By means of scales, the ratios of the age classes composing the catches were determined.
4. The rate of growth for the fishes of each lake was also determined.
5. The fishes from the lakes with the heaviest fishing showed a slower growth rate.
6. This corresponds with the growth rate of fishes from heavily fished lakes near the Twin Cities.

HARDINESS OF WOODY PLANTS IN MINNESOTA

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The continental climate of Minnesota limits the number of species of trees and shrubs that are hardy here to a relatively small number as compared with other sections of the United States. Indeed, Minnesota and North Dakota are in the lowest zone in Rehder's map of hardiness. The long period of cold when there is no intake of water by the root system but when twigs and needle leaves give out water leads to so-called winter-killing. Likewise long periods of summer drought may lower the water level so that species ordinarily hardy may kill out from that cause. The result is that the material with which the landscape gardener can work with assurance of success is all too limited and indeed is discouraging when compared to the wide selection available to the gardener in zones