herbarium specialists at the University of Wisconsin-Madison were identified as *V. corymbosum* L., the first collection of this species in Wisconsin.

Seeds of this blueberry were collected and germinated. Softwood cuttings taken from several of the resulting seedlings have rooted readily when placed under mist in a peat-Perlite medium. We have conducted no genetic studies nor have we made controlled evaluations of this material for climatic adaptation or fruit quality. Seeds from the original plants were provided to Dr. Cecil Stushnoff, University of Minnesota, St. Paul, MN.

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BREGGER STUDENT AWARD PAPER (1979): Polyploid Breeding: A Valuable Tool for Fruit Crop Improvement

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METHODS OF POLYPLOID BREEDING

There are two principal methods of polyploid breeding used to improve fruit crops (7). Certain crop plants can be improved by simply doubling their chromosome number. This method is called autopolyploidy. Grapes are an example of a crop subject to improvement by this method. Some autopolyploid grapes of the Portland and Fredonia varieties produce berries almost twice the weight of their corresponding diploids (6). Since autopolyploids are often partially sterile, this method of breeding works best on vegetatively propagated crops where seed yield is of secondary importance (13).

The second method untilizes the hybridization of species differing in ploidy levels (for example, crossing a diploid with a tetraploid). This method probably has greater potential than autopolyploidy for improving present-day fruit crops and also for creating new ones. The loganberry, a relatively new fruit, resulted from the hybridization of the blackberry and the raspberry. It consists of four sets of chromosomes from the blackberry and two sets from the raspberry (7). New cultivars of triploid citrus, hybrids between diploid and tetraploid citrus, have been created with the desirable characteristic (to the consumer) of being seedless (3).

Polyploid breeding can be used to transfer valuable genes from native species to cultivars or from cultivar to cultivar. Sharpe and Sherman (15) have transferred low chilling genes from a native diploid blueberry, *Vaccinium darrowi Camp,* to northern highbush cultivars (tetraploid). Work is currently under way at the University of Florida to transfer the early fruiting and flavor characteristics of northern highbush cultivars (tetraploid) to southerly adapted rabbiteye cultivars (hexaploid).

POLYPLOID INDUCTION

Polyploid induction usually refers to the doubling of chromosome numbers by man. The use of the alkaloid colchicine to double chromosome num-

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bers has been well documented (8, 11, 2, 14). Theoretically, a whole tissue can be changed from diploid to tetraploid by exposing the tissue to colchicine for the length of time it takes the meristematic cells to complete a divisional cycle (8). The most common types of plant material treated with colchicine are seeds, seedlings, and growing shoots and buds.

High mortality has resulted when germinating seeds were immersed in a colchicine solution for extended periods (8). But, Dermen (8) was able to reduce mortality and still induce polyploidy in *Cosmos* by moistening the soil over and around germinating seeds with a colchicine solution. Aalders and Hall (1) found that by treating germinating blueberry seeds in an aerated colchicine solution, mortality could be reduced to very low levels, even with extended treatments.

Working with shoots of grape, Iyer and Randharva (11) were able to increase their polyploid induction percentage by first etiolating the shoots and then treating with a colchicine solution to which gibberelic acid (10 ppm) was added. Etiolation and GA seem to increase the percent of polyploid induction by making the shoots more permeable to colchicine and by speeding up the cell divisional cycle.

POLYPLOID MANIPULATION

Polyploid manipulation involves changing the ploidy level of breeding material up or down. Ploidy levels can be raised by doubling as previously described or by taking advantage of the fertilization of unreduced gametes (i.e., gametes with the same number of chromosomes as the plant that produced them).

Frost (10) used unreduced gametes to obtain triploid citrus from diploid parents. Triploid apples have also been produced from the fertilization of unreduced gametes. To get a reasonable number of triploid progeny, large seedling populations usually have to be grown. One possible way to reduce the need for such high populations is to save the seeds from packhouse discards, visually select the largest seeds, grow the seedlings out and select for leaf size and vigor (4).

Ploidy levels can be lowered by taking advantage of parthenogenesis (i.e., the development of an unfertilized egg). Chase (5) proposed a breeding scheme for the commercial (tetraploid) potato that entails, first, going down in ploidy level and then back up again. He summarizes the procedure as "a) the reduction of a polyploid to its diploid components, b) the intensive breeding and selection at the diploid level, and c) resynthesis and testing of the polyploid form." Breeding and selection are proposed at the diploid level because, in theory, selection is easier due to the greater segregation of recessive traits. Recessive genes in a polyploid species tend to stay hidden. This makes genetic analysis, as Janick (12) concludes, ". . . exceedingly complex."

Polyploid manipulation is of greatest value to those commercial crops (like the potato) that have a relative(s) with valuable traits at another ploidy level.

SCREENING FOR POLYPLOIDY

The macroscopic effects most often associated with polyploid induction are broader, thicker leaves, thicker stems, larger flowers and fruits, a more pronounced venation pattern, and fertility in hybrids not fertile as diploids (6, 8, 13, 14). A micrometer graduated in hundredths of millimeters can be used to measure leafblade and stem thickness; a small metric rule can be used to measure leaf shape (described as length/width) (3). To examine the venation pattern in citrus, Barrett and Hutchinson (3) suggest viewing the leaf blade in front of strong light through a hand lens. Polyploidy may cause changes in the intensity of color or fragrance of a plant (8, 2, 9). However, leaf color is not always a reliable screening tool because nutritional and other environmental factors may mask color differences (3).

The microscopic effects most often associated with polyploid induction are the increased size of the stomates and pollen (3, 8, 14). Barrett and Hutchinson (3) point out that measuring stoma size is too slow and tedious to use as a method of screening large seedling populations; however, it is a useful check. The detection of induced polyploidy by the use of pollen measurements is more accurate than the stoma size method (8) but plants in the flowering stage must be used; whereas stoma measurements can be taken at the seedling stage.

While the screening methods mentioned above are useful, only the counting of chromosomes can be used to confirm polyploid induction (8, 9, 3).

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BREGGER STUDENT AWARD PAPER (1979): Origin of the Macoun Apple Cultivar

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Today the Macoun apple cultivar is enjoying renewed interest. Its popularity is increasing for use in both the home garden and commercial production. Macoun is ideal for both retail sales and pick-your-own operations when on the M.9 rootstock. The regeneration of interest in Macoun is due primarily to its excellent fresh eating quality. Some experts consider

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