2. PROPAGATION AND PRESERVATION OF ELMS VIA TISSUE CULTURE SYSTEMS

D. F. KARNOSKY AND R. A. MICKLER

Director, Center for Intensive Forestry in Northern Regions, Department of Forestry, Michigan Technological University, Houghton, Michigan 49916, and Research Associate, New York Botanical Garden Cary Arboretum, Box AB, Millbrook, New York 12545

ABSTRACT

Tissue culture systems offer opportunities to propagate, select preserve, and improve forest trees. This paper discusses the status of callus, suspension, anther, and protoplast cultures and cryopreservation in elms. These findings are related to broader uses in reforestation programs. The paper also describes some research needs in each of these areas.

2.1 INTRODUCTION

2.1.1 Importance of elms

For many centuries, the elms (Ulmus spp.) have been important components of forests, hedgerows, windbreaks, and urban areas in north temperature regions around the world. Elms have been used for over 2,000 years in Europe, Central Asia, and China for cattle feed. More recently they have been used for many different types of wood products, including boats, piles, furniture, veneer, paneling, flooring, containers, fence posts, and caskets.

The most conspicuous use of elms, however, has been in landscape plantings. Elms have been extensively used in urban and suburban landscape plantings, especially in Europe and North America.

American elm (Ulmus americana L.), perhaps the most popular of the more than 25 elm species and often referred to as one of nature's noblest vegetables, was planted very commonly along street sides and in parks across North America in the 1800's and early 1900's. Because of its elegant vase-shaped crown and high,
arching branches which create a cathedral-like effect over streets, American elm was often planted in near monocultural fashion in large and small cities alike. This did not seem risky at the time since American elm exhibited excellent urban hardiness, being tolerant of de-icing salts, air pollution, and soil compaction, and growing rapidly on a wide variety of sites and soil types (7, 8).

2.1.2 Elm diseases

America's love affair with American elm came to an abrupt halt in the middle of this century when the devastation of Dutch elm disease became apparent. First identified as a problem in Europe at the end of the First World War, Dutch elm disease, caused by the vascular-wilt fungus *Ceratocystis ulmi* (Buisman) C. Moreau started to kill trees in North America in the early 1930's. During the some 50 years that the disease has been present in North America, its range has steadily increased and it has now killed an estimated 50 to 100 million elm trees from coast to coast. Large cities such as Buffalo, Chicago, Milwaukee, Minneapolis, and St. Paul have lost hundreds of thousands of elms.

A second major disease problem of elms has begun to raise havoc with the remaining elm populations in this country. For the past twenty years, phloem necrosis has been increasing in importance in the eastern United States. Also called "elm yellows", this disease is caused by mycoplasma-like organisms. Together, Dutch elm disease and phloem necrosis make any additional planting of American elm in North America risky at best.

2.1.3 Tissue culture systems applied to elm improvement

Most elm improvement programs have concentrated on utilizing disease resistance from Asian and European elm germplasm in various hybrid combinations. Among the most promising elms for disease resistance are two Asian elms, Chinese elm (*U. parvifolia* Jacq.) and Siberian elm (*U. pumila* L.). Unfortunately, these resistant elms do not have the crown shape, form, and public acceptance of the American elm. Thus, a hybrid with the ornamental characteristics of American elm and the disease resistance of the Asian