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NU nes SOD HARVESTER

CIRCLE No. 1 READER CARD

The Cover

Majestic elm featured this month is victim of Dutch elm disease, and is representative of the real tragedy which has ravaged this vintage type tree in America.

This particular elm had been saved by a yearly spray program until this past season when the homeowner decided to take the chance and failed to negotiate a new spray order with his tree care company. Result was loss of an asset, not only to his property but to the community, which is irreplaceable.

For this special shade tree issue, WTT has asked Dr. Richard Campana, past-president of the ISTC and a research pathologist at the University of Maine to present a round-up of research and current control efforts on Dutch elm disease in America. His article begins on page 6.

Eliminate Guesswork in Chemical Spraying

Guesswork is foolish when applying chemical controls for weeds, insects or diseases, says Frank E. Boys, agricultural chemical specialist at the University of Delaware.

Less than the recommended herbicide rate can result in less than satisfactory weed control, he says. An overdose may kill or seriously injure an entire crop.

To eliminate the guesswork from your spray program, calibrate spray equipment before applying chemicals, Boys advises. Be sure to accurately measure the correct amount of pesticide and water before spraying.

Measure the size of the fields to be treated, as mere estimation of acreage increases chances of using improper spray rates.

WEEDS TREES and TURF

FORMERLY WEEDS AND TURF

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Beauty for Posterity

This month WEEDS TREES AND TURF magazine salutes the tree care industry in general and International Shade Tree Conference members in particular. This group, made up primarily of professional arborists, has been interested in beautification since the 1920's when they first started getting together. Their program of establishing trees along with tree care and management not only preceded by many years the current National Beautification Program but meant that a previously established action program, national in scope, along the lines of beautification was already accomplishing much in our cities and along our highways.

The recent national beautification effort came at a time when the country proved to be ready for beautification. It served to give impetus to the entire industry of arboriculture. ISTC members deserve much of the credit.

This month the International Shade Tree Conference membership is meeting at Chicago for their 44th convention and trade show. Some 1000 members and friends will register and take part in this event. Tree problems and research affecting them will be studied along with numerous subjects affecting arboriculture. Through the efforts of the ISTC these problems have become a concern of our citizenery.

The ISTC has made great strides in areas which have served to standardize tree care and management. Their shade tree evaluation work done in cooperation with the National Arborist Association is basic to the industry. Similar educational ventures have proved equally beneficial.

Of most import for the professional arborist has been the establishment of local ISTC chapters throughout the nation. These chapters meet regularly and serve as a year-round forum for industry progress. Legislation, especially municipal ordinances, has been developed and followed through to adoption via local chapter action. Local chapters also serve as a means of communication between local members and as a stimulus for progressive programs of the national conference group.

We therefore salute ISTC and the NAA and appreciate the opportunity to be a part of their progressive program.

WEEDS TREES AND TURF is the national monthly magazine of urban/industrial vegetation maintenance, including turf management, weed and brush control, and tree care. Readers include "contract applicators," arborists, nurserymen, sod growers, and supervisory personnel with highway departments, railways, utilities, golf courses, and similar areas where vegetation must be enhanced or controlled.

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CIRCLE No. 3 READER CARD

Dr. Richard J. Campana, left foreground, participates in tree planting ceremony at 1967 International Shade Tree Conference at Fairmount Park, Philadelphia. Dr. Campana, chairman of the department of botany and plant pathology at the University of Maine and one of the foremost researchers actively searching for new methods of control for Dutch elm disease, is the immediate past president of ISTC. He agreed to relate his experiences and observations regarding the national DED program at the request of WEEDS TREES AND TURF magazine. The editors are happy to publish this extensive insight into the problem by Dr. Campana.

Dutch Elm Disease:

A Matter of Priorities

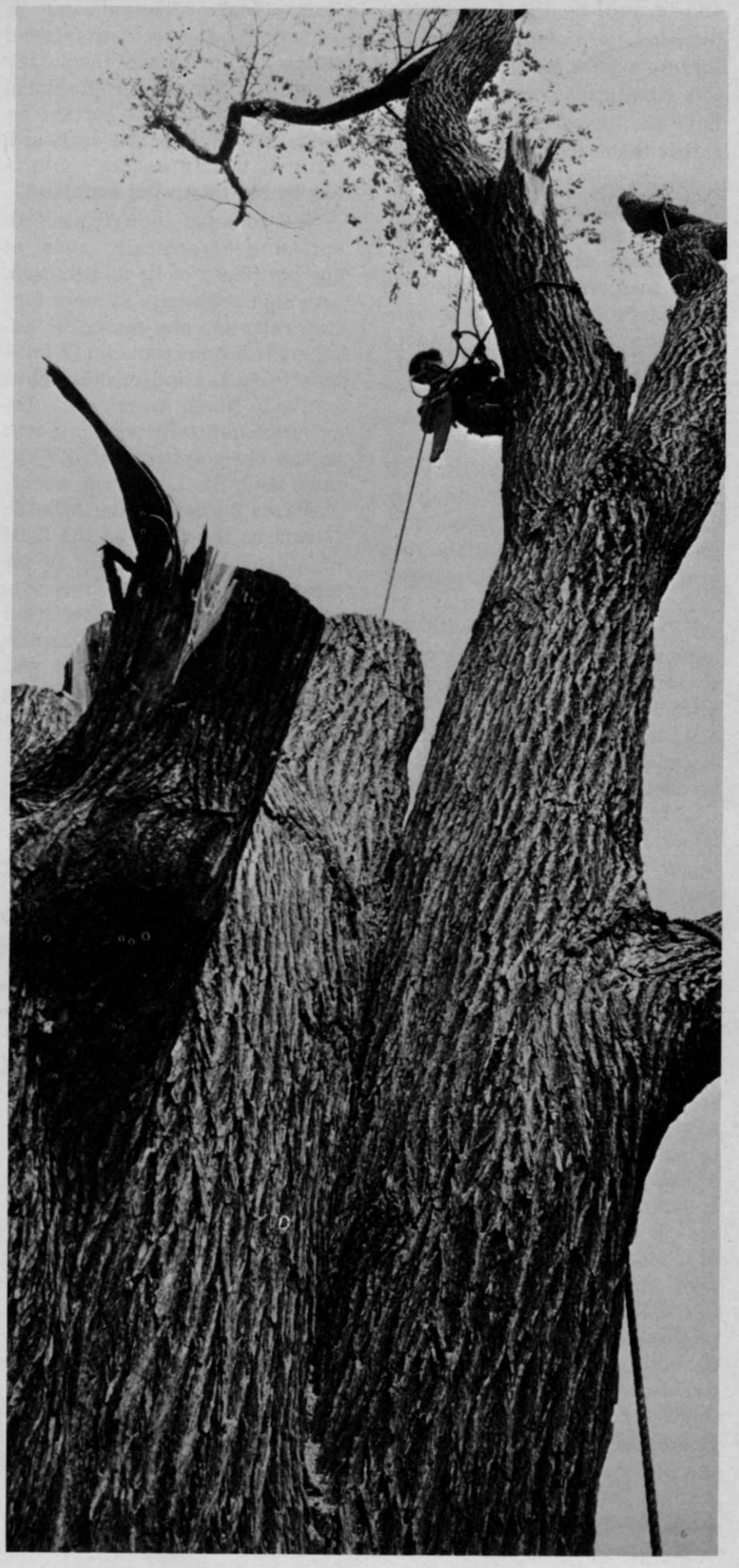
By DR. RICHARD J. CAMPANA
University of Maine
Orono, Maine

THE DUTCH elm disease is an American tragedy. Introduced inadvertedly to the United States from Europe by 1930, it rages unabated through native elms of field and forest, and seems slowed only temporarily and sporadically in relatively few urban areas at great cost in time, labor and money.

It is the most serious and devastating shade tree disease in North America. Not only has elm been one of the most populous species in most cities and towns in midwestern and northeastern United States; but elms are natively distributed throughout the eastern half of the U.S. as a forest tree principally along streams. The disease is unusually serious because it kills most trees once the main stem is affected, it continues to spread and intensify each year, all species of elm are susceptible to some degree, it creates ideal conditions for proliferation of elm bark beetles which make its greater distribution possible, and at present there is no known cure for trees affected. The disease is characterized by wilting of foliage caused by clogging of water conducting vessels, and is caused by a microscopic fungus, *Ceratocystis ulmi* (Buism.) C. Moreau, which multiplies and moves in such vessels. The fungus may be spread from diseased to healthy trees by root grafts

between such trees, or by either one of two elm bark beetles (the native American, *Hylurgopinus rufipes* Eichh.; or the introduced European, *Scolytus multistriatus* Marsh.) The origin of the disease is obscure. It appeared unexpectedly and unknown in war-torn areas of Western Europe following World War 1. In Europe it spread throughout the continent and destroyed extensive elm stands wherever it occurred. In Canada and the U.S. it spreads unchecked through native elms of field and forest, and continues to decimate urban elm populations in the absence of effective measures to prevent its spread. It is truly a tragedy of monstrous proportions which continues to unfold before our eyes with each succeeding disastrous period of new infections. The disease may be controlled only in the sense that its toll may be limited, and only within limited areas requiring substantial effort on the part of local residents.

As the Dutch elm disease continues to spread, it probably now destroys millions of trees annually. Moreover, it continues to stimulate public interest and emphasizes clearly the inability to prevent its spread from one area to another. Unfortunately there is much misunderstanding and widespread ignorance about many aspects of the disease. Even among research entomologists and plant pathologists there is disagreement on its many aspects. It is obvious, that among scientists many points of conflict arise, either where there is no evidence at all, or where the evidence is merely indicative but not conclusive. In any event, after 16 years of continuous work with the disease, it has become increasingly apparent to the writer that Dutch elm disease is far more complex as a biological phenomenon than most realize. During this period, many of us have accepted too easily without critical evaluation, not only ideas for miraculous prevention



and/or cure by chemical magic, but also more plausible ones affording a false sense of security. The significant point is, that we have often accepted ideas as facts, rather than recognizing them for what they really were, as hypotheses, assumptions or conclusions derived from assumptions. In practice, perhaps the most serious mistake we have made is to educate the public to the advantages of spraying, without stressing strongly enough either the meticulous thoroughness and timing required for effective application of suitable chemicals, or the relative inadequacy of spraying without prior and proper attention to sanitation, and treatment for potential root grafts. The purpose of this paper is to present some new views on the Dutch elm disease with the hope that they may help to clarify certain aspects of this most difficult biological puzzle. Various aspects of the disease will be discussed under the subtopics of: spread and distribution, susceptibility, symptoms, diagnosis, transmission and control. There is no attempt here to discuss any of these topics at length; emphasis is placed only where the writer believes there has been misunderstanding and possible misinformation.

Spread and Distribution:

The disease continues to spread at three levels: from state to state; from area to area within states; and from one section of urban control zones to others. It is now known to be within an area bounded by: the provinces of Quebec, Ontario, New Brunswick and Nova Scotia, Canada, in the North; the Atlantic Ocean in the East; the states of North Carolina, Tennessee, Oklahoma, Arkansas and Texas in the South; and the states of Kansas, Nebraska and South Dakota in the Midwest. Isolated infections were reported from Denver, Colorado over ten years ago, and only within the past year from Boise, Idaho. The disease is known to be present within all states and provinces inside the larger, contiguous, geographical area, as well as on certain islands off the eastern seaboard, some of which are not contiguous by road with the mainland.

The disease continues to spread geographically even at the periphery of its distribution, although seemingly at more limited rates for one reason or another. The American elm *(Ulmus americana* L.*)* and/or other elms native to North America are distributed naturally as far north as the river systems of the Ottawa and St. Lawrence watersheds, as far east as the Atlantic Ocean, as far south as the Gulf of Mexico and generally as far west as the numerous river systems will alow in the the Great Plains (i.e. in The Dakotas, Nebraska, and Kansas). It was surprising to the writer to learn that the American elm is even known to be present in the foothills of the Black Hills of Wyoming.

In the North it is likely that spread of the disease is limited by extremes of cold which preclude or limit occurrence of one of the insect vectors *(Scolytus multistriatus* Marsh.*)*, considered by many to be the more effective of the two known carriers of the causal fungus. In the East the only deterrent to spread of the disease seems to be the Atlantic Ocean, which limits to a great degree transportation of contaminated elm wood, as well as aerial transmission of bark beetles and viable inoculum. However, road access to large islands, such as Long Island in New York and Mt. Desert Island in Maine, makes such islands easy targets. On the other hand, to the extent that they have native or introduced elms, islands isolated by substantial stretches of open water are less easily invaded by the disease.

In the south the disease ap-

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pears to be limited both by temperature and less dense populations of both native and planted elms. In transmission from elm to elm the fungus on the body of the insect vector is expected to remain viable longer under conditions favoring slow desiccation. Also, the fungus is limited in growth and development by high temperatures. To the extent that the degree and duration of the heat of the South favor rapid desiccation of viable spores, and limit growth and reproduction of the fungus on or in the host trees, they should be expected to act as deterrents. On the other hand, possibly the heat and high humidity of the South could favor the European elm bark beetle, so that it may produce more than two broods per year. But even if this were possible, it would not be expected to increase the probability for spread to a significant degree, because of the primary importance of the first brood. However, I have seen no data on this.

In the West spread of the disease seems only to be limited by native occurrence of the elm itself. However, its occurrence beyond native distribution, into urban areas first in Colorado and more recently in Idaho should be instructive. It reemphasizes the role that man plays in spread, and thus should serve as another living warning that elm populations, however remote beyond the range of native elms, are still open to invasion with the help of man in all his multitudinous activities and travels. However careful we should try to be, it is not unlikely that the disease could be introduced inadvertedly into the relatively cool, wet and most favorable climate of the Northwestern states of Oregon and Washington, and the province of British Columbia. The apparent elimination of infections in Denver, and the possibility of elimination in Idaho, should not lull us into a false sense of security where more favorable conditions may occur for survival of the fungus. If the disease gets into coastal Washington, Oregon and/or British Columbia, only the occurrence and distribution, or lack thereof, of elm populations would seem to be significant as natural factors favoring control.

Susceptibility:

The American elm has long been recognized by many authorities as the most susceptible to Dutch elm disease of all elms known to man. Also, it is conceded generally that native European and especially native Asiatic elms have greater resistance to the disease than do most North American species. Various hybrid selections of European and Asiatic elms have been reported to have a degree of resistance close to immunity. However, it should be clear, that it is almost impossible to be certain of high resistance under all conditions, since variation in strains, and thus virulence, of the fungus may change. We have every reason to believe that sexuality and hybridization by the causal fungus are common, thus new strains and capacities of virulence are possible continuously. However, this should not discourage us from seeking resistant varieties, even in the most susceptible American elm.

With the American elm in particular, a considerable degree of resistance to one or more strains of the fungus is becoming increasingly apparent. This is evident, when, of hundreds of trees inoculated with a single fungus strain, only a fraction become diseased, and many of the diseased trees recover. On the other hand, with certain other strains more often than not, most of several hundred trees inoculated do become diseased and die. Unfortunately, it is probable that most naturally diseased trees are infected by multiple fungus strains with varying degrees of virulence. This is apparent where sexual fruiting structures of the fungus are found naturally produced in many diseased trees. This phase of the life cycle of the fungus is possible when 2 different, but compatible mating strains are present in the same tree, indicating the distinct possibility of different genetic capacities for disease causation. Another example, illustrating variability in virulence, may well be the single large tree surviving, when all others surrounding it are killed. Such a tree is often easily infected and killed if inoculated deliberately with a pure culture of the fungus. In the past we have often regarded such trees as "fortuitous escapes" lucky enough to have been inoculated naturally. While this may often be so, it is more probable that such trees are actually exposed to no more than a single fungal strain. It is also possible that they either failed to become infected, or did become infected, but recovered. They could then easily become diseased later from a different fungal strain. Fortunately, in many cases, they may never

Recent Symposiums on Dutch Elm Disease

Two major symposiums on Dutch elm disease have been held during the past year, one a regional meeting during June, 1967, at the US Forest Service Laboratory, Delaware, O., and an international symposium, February, 1968, at Iowa State University, Ames, Ia. Copies of proceedings are available respectively from John W. Peakcock, recording secretary, Northeastern Forest Experiment Station, Box 365, Delaware, O., and Iowa State University Press, Iowa State University, Ames, Ia.