ECOGNITION AND CONTROL OF UTCH ELM DISEASE IN THE RAIRIE PROVINCES

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Dutch elm disease, caused by the ngus *Ceratocystis ulmi* (Buism.) C. reau, was first observed in Holland d France in 1919. It was found in the ited States in Ohio in 1930 and in nada in Richelieu County, Quebec 1944, the causal fungus having en introduced directly from ope in diseased elm wood from ich the bark had not been com- tely removed. Since then the dis- e has spread throughout most of natural range of elms in North erica, and has destroyed millions trees.

n 1975, three outbreaks of the dis- e were diagnosed in Manitoba at ndon, Selkirk, and Winnipeg. All curred in picnic grounds and npsites adjacent to the Red and iniboine rivers where the trees are der stress due to annual spring oding. How the fungus arrived at sites is uncertain, but possibly it s introduced by tourists carrying eased firewood, or by infected etles carried on vehicles from On- o and the United States. There was evidence that it was spread from nnesota by infected logs carried vnstream on the Red River during ing runoff.

ecause these outbreaks created a ous hazard to adjacent healthy s, the Manitoba Department of ficulture and the City of Winnipeg mediately implemented control grams. However, despite the noval of hundreds of dying and ently dead trees during the fall and ter of 1975, the outbreaks spread 1976. Increased incidence of dis- ed trees was particularly notable in Brandon and Selkirk areas, where problem was exacerbated by high pulations of elm bark beetles, ch are responsible for spreading disease.

Even though the disease has not been detected to date in Saskatchewan and Alberta, it will ultimately spread to all natural and planted elm stands in the prairie provinces unless preventive action is taken now.

History shows that the most important factor affecting progress of the disease is the concentration of host trees. Native American elm stands are restricted to lakeshores and river valleys in the eastern prairies. Because they afford an abundance of breeding material for elm bark beetles it is expected that these stands will be completely devastated in the next decade. If selected native stands of elm located in cities and towns within these areas are to survive, they should be protected by immediate tree sanitation and bark beetle suppression programs.

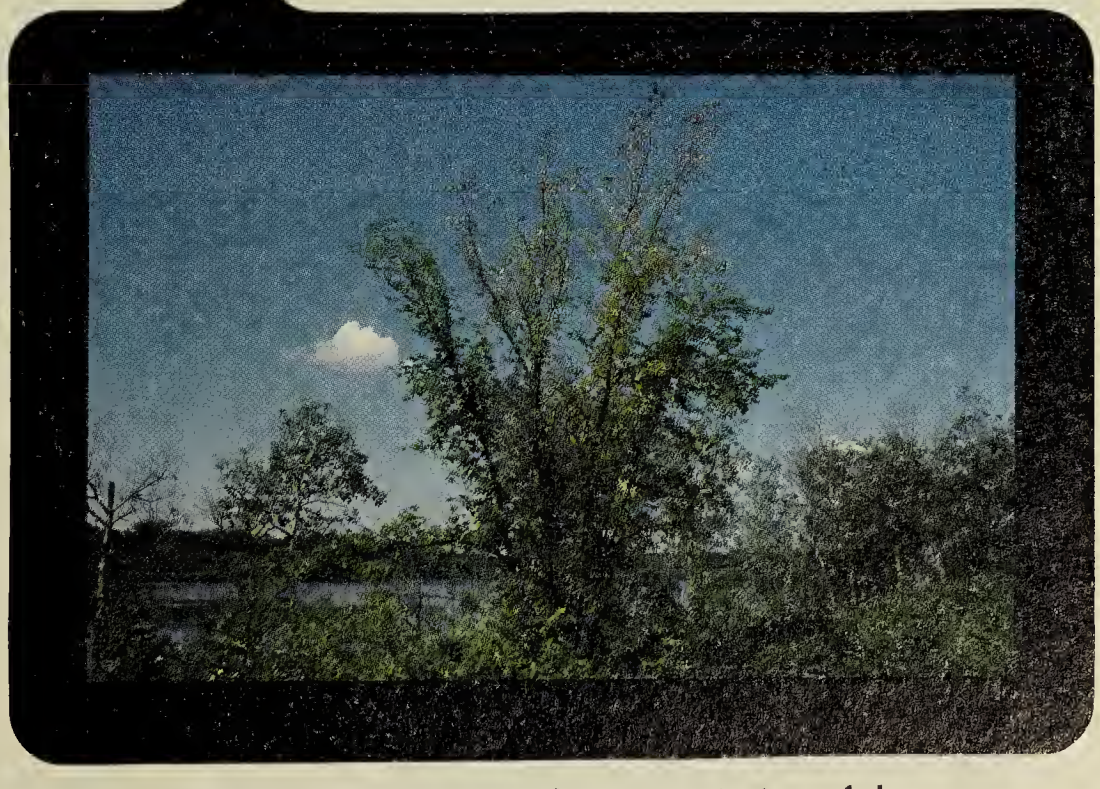
Fortunately, most planted American and Siberian elms appear to be in less danger because of their isolated occurrence and distance from large continuous native stands of elm. Elms in major cities such as Regina, which has 68,000 planted elms, Saskatoon, which has 40,000, and Edmonton, which has 56,300, are not in imminent danger from the natural spread of the disease. However, there is always the danger of long-distance transport of spore-carrying beetles and diseased elm wood to unaffected areas by man. If this happens, the disease will probably occur first as single-tree infections, but by good management it should be possible to preserve most urban elms for many years. Immediate implementation of systematic detection surveys and recommended prevention practices by provincial, urban, and rural governments will be vital in preven-

Dutch Elm Disease

Wilted leaves are the first external symptom of early season infection.

Flagging in crown is characteristic of early season infection.

Tree killed by Dutch elm disease. Brown, wilted leaves remain on the tree.



Yellow-wilted leaves are characteristic of late-season infection.

ting the establishment and reducing the impact of the disease.

SYMPTOMS AND DAMAGE

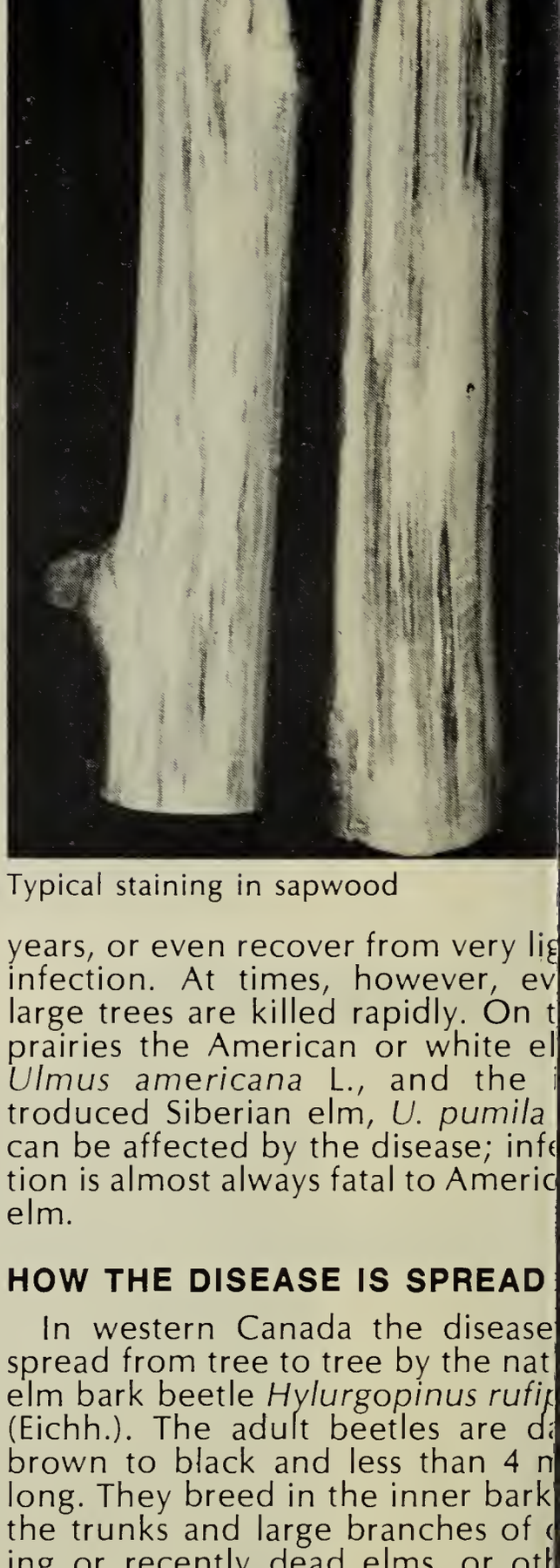
The first noticeable symptom of the disease is sudden wilting of the leaves on one or more branches. These leaves later shrivel and turn brown, many persisting on the tree into winter. Leaf wilting caused by early-season infection is evident by mid-June but is most pronounced in July. After development of the foliar symptoms, affected branches die and the condition spreads until the tree dies.

Late-season infections, which are characterized by yellowing and wilting of the foliage followed by premature leaf drop, are often difficult to distinguish from natural autumn coloring of the leaves. Elms may also leaf out in the spring with smaller than normal leaves on part or all of the tree, and some branches may be dead. This generally indicates that the tree was infected the previous year, but too late in the season to express the normal symptoms.

Internally the disease appears as long, discontinuous dark brown streaks on the outer sapwood under the bark of infected stems. If the stem is cut in cross section, the discoloration forms a dark brown ring.

The symptoms of Dutch elm disease are similar to those of two other common diseases of elm, *Verticillium* wilt and *Dothiorella* wilt. These are less destructive because they are transmitted more slowly either through the soil or through the leaves by defoliating insects. Because of the similarity of symptoms, however, positive identification in the field is not possible and it is necessary to collect samples and culture the fungus in the laboratory.

Trees of all sizes are affected by Dutch elm disease, but the progress of disease varies with a tree's age and growing conditions. Young, vigorous trees may die within a few weeks, while slow-growing trees may survive the initial attack for two or more years, or even recover from very lig infection. At times, however, ev large trees are killed rapidly. On t prairies the American or white el *Ulmus americana* L., and the troduced Siberian elm, *U. pumila* can be affected by the disease; infe tion is almost always fatal to Americ elm.



Typical staining in sapwood

HOW THE DISEASE IS SPREAD

In western Canada the disease spread from tree to tree by the nat elm bark beetle *Hylurgopinus rufip* (Eichh.). The adult beetles are da brown to black and less than 4 m long. They breed in the inner bark the trunks and large branches of ing or recently dead elms, or oth suitable elm material. The fem constructs two diverging bro galleries which form a broad V acr the wood grain. The eggs hatch a the larvae feed in galleries co structed at right angles to the bro galleries. When fully grown, the l vae pupate and emerge as adults the brood tree was killed by Du

native elm bark beetle

disease, the causal fungus duces spores in the brood ries and the emerging adults are aminated. When feeding on liv- elms they can introduce the es into the water-conducting s of the tree, initiating a new in- on.

ere appear to be two fairly dis- groups in the beetle population: ne that emerges as adults in the nd overwinters in bark near the of living elms, and (b) one that winters as larvae in the brood .

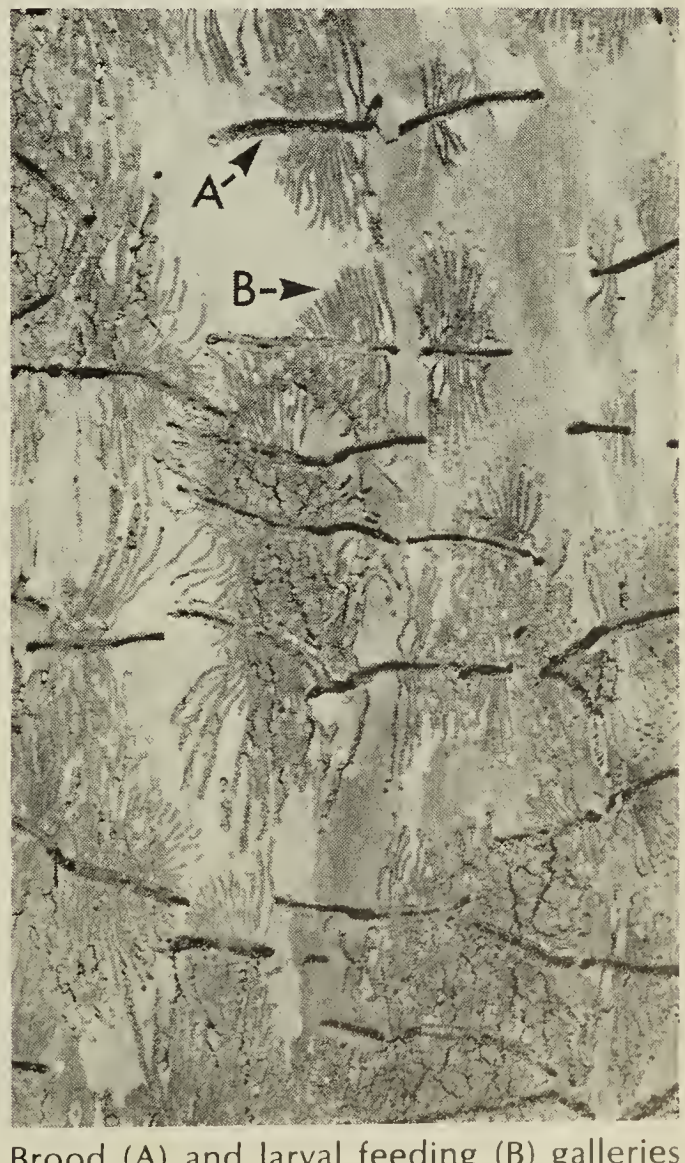
e overwintering adults (group a) nerge in mid-April to early June feed briefly on the branches of hy elms before laying eggs in dy- rees or recently cut elm wood. of their offspring emerge in late ner and feed until fall before ructing tunnels for hibernation. boring dust in the bark fissures of elms in fall and spring indicates wintering bark beetles. Adults n picked up the fungal spores revious year and remained con- nated overwinter are responsible arly-season infections.

e overwintering larvae (group b) ge as adults in late June through and after feeding on living elms ggs in dead and dying trees. s that emerge from this group e the late-season infections h are usually less common.

In the United States and eastern Canada, the smaller European elm bark beetle, *Scolytus multistriatus* (Marsh.), is also responsible for spreading the disease. It differs from the native elm bark beetle by constructing a single brood gallery parallel to the grain of the wood and feeding in twig crotches. This species has not yet been reported in the Prairie Provinces.

PREVENTION

In areas where Dutch elm disease is not present the immediate implementation of tree maintenance and sanitation programs is essential to prevent it becoming established. Good tree maintenance, including pruning, watering, fertilizing, and insect control, will ensure healthy vigorous elms. Sanitation cutting to reduce potential breeding sites for the bark beetle is also a must. This means the prompt removal and



Brood (A) and larval feeding (B) galleries of native elm bark beetle

destruction of unhealthy, dead, and dying elms, broken and dead branches on living trees, and stumps with bark present (to ground level). Trees salvaged for lumber must be immediately and completely debarked and the waste material destroyed.

Good tree maintenance and sanitation should be practiced by individuals and government agencies in urban and rural areas alike. Communities that have stringently practiced sanitation have reported notable success. For example, in the United States, sanitation programs in Chicago from 1957 through 1971 and Syracuse from 1951 through 1964 kept losses to less than 2% of the elm population annually. Many cities without sanitation programs lost 80-95% of their elms by 1966. A similar program in Fredericton, New Brunswick limited losses to 5.3% of the initial elm population.

CONTROL

In areas where Dutch elm disease is present, tree maintenance and sanitation programs are also essential to reduce losses. Spraying with insecticides to reduce bark beetle populations is also important in preventing disease spread. At present methoxychlor is the only insecticide registered in Canada for use against elm bark beetles. Trials are being conducted on new insecticides, particularly potential trunk-base sprays to be applied in late summer to control the overwintering adult bark beetle population in healthy elms. These sprays may be relatively ineffective unless brood wood has been virtually eliminated beforehand in the area. The program must include all elms within an infected area; spraying individual trees will not control the disease.

A method of reducing the chance of infection and curing lightly infected trees has been developed by the Canadian Forestry Service. The treatment involves the low-pressure injection of Lignasan-P (methyl-2-benzimidazole carbamate-phosphate), a systemic fungicide, into the roots or root flares (the area of tree where the trunk meets the ro Research shows that if applied rectly, the chemical remains effec up to two years. Because tree in tions are costly and can be done under license from the Ontario S Tree Council, they will probably most useful for protecting high-v trees in urban centers.

YOUR HELP IS NEEDED

Control of Dutch elm disease is the sole responsibility of governm A vital step in restricting its sprea the prairies will be early detectio new outbreaks. This can be gr assisted by the vigilance of natura horticulturists, and other conce citizens. When an elm with suspi symptoms is observed, the propriate authorities should be formed immediately.

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kly rose

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