

HMSO 7p net

Forestry Commission
Leaflet

54

Forestry Commission
ARCHIVE

The Control of Dutch Elm Disease

D A Burdekin J N Gibbs



© Crown copyright 1974

First published 1972

Second edition 1974

Front cover: Fig. 1a, left. Dead elm trees in mid-summer. A less severely affected tree can be seen in the background. Fig. 1b, right. Early wilt symptoms on vigorous elm shoots.

THE CONTROL OF DUTCH ELM DISEASE

by D. A. BURDEKIN, B.A., DIP.AG.SCI. and J. N. GIBBS, M.A., PH.D.

Forestry Commission

Introduction

By the end of 1972 Dutch elm disease had killed so many elms in Southern Britain that sanitation felling on a national scale was not a feasible proposition and the main campaign against the disease was ended. Since then interest in the worst affected areas has been concentrated on measures aimed at saving trees of high amenity value. Where the disease is still at a low level, the main control method remains the destruction of sources of infection and to this end, restrictions have recently been placed on the movement of diseased elm in parts of the country. In addition, certain local authorities have powers to prevent the spread of infection.

The Disease

The disease is caused by a fungus, *Ceratocystis ulmi*, which is spread in Britain by two species of elm bark beetles, *Scolytus scolytus* and *S. multistriatus*. The first symptoms, which appear from June onwards, include wilting of shoots and subsequent yellowing or browning of the leaves (Figure 1b). When an infected branch is cut across, dark spots can be seen in the wood, often in sufficient number to form a ring. These spots can be seen as streaks in the wood in longitudinal section (Figure 2). Affected branches begin to die back from the tip, which sometimes curls over to form a 'shepherd's crook'. Leaves fall and large branches or entire trees may die in a matter of weeks (Figure 1a).

Such a dead branch or tree affords ideal breeding material for the elm bark beetles. Eggs are laid and the resultant larvae overwinter in the bark, emerging in their thousands as young adult beetles the following spring. Before breeding, these young adults feed for some days on young twigs of healthy trees and, because they are frequently contaminated with

the fungus, this feeding may result in infection. Thus the disease cycle is completed. For its spread over a distance the fungus depends on the bark beetles, but infection can also pass from diseased to healthy trees through the root system (see pages 4 and 5).

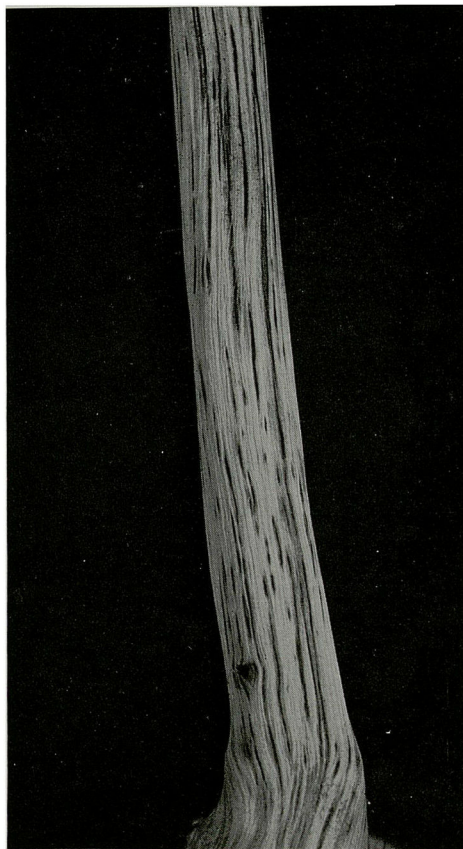


Figure 2. Elm twig with the bark removed, showing streaks caused by the fungus *Ceratocystis ulmi*.

A full account of the biology of the disease can be found in Forestry Commission Forest Record No. 94, *The Biology of Dutch Elm Disease*, HMSO (in the press).

Control by Sanitation

Although attempts to control Dutch elm disease on a national scale by means of sanitation felling have now ceased, this control method is still vital in areas where infection is light. It is particularly important when the first disease focus is identified in an otherwise unaffected area. Other favourable situations exist where largely healthy elm populations are surrounded by areas in which elm is rare or absent. Such barriers to disease spread may be provided by geographical features such as hills, large towns or expanses of water. In addition there is evidence that Wych elm and the Smooth-leaved elms are somewhat more resistant to the disease than English elm, and where these are the main components of the elm population the prospect of successful control by sanitation seems to be greater.

The basis of this sanitation approach is the reduction of the population of the beetle through the destruction of its breeding grounds in the bark of dead and dying elms. There is no need for a tree to be felled at the first sign of infection. Provided that the disease remains localised in a few small branches, the tree should be given the chance to recover. Once however the disease becomes severe in the tree, such that more than half the crown is affected, it should be felled.

Felling should be to ground level and after this the bark must be destroyed. Except where spraying with insecticides is an acceptable alternative (see next column), all bark must be destroyed either by burning the entire tree, or if the timber is to be used, by the removal and burning of the bark alone. Beetles can also breed successfully in the bark of felled or windblown healthy trees and thus wood piles, or timber from such trees, can contribute to the disease hazard. Material of this type must be treated in the same way as that from diseased trees.

Elm bark remains suitable for beetle breeding for up to two years. Trees which have passed this stage have no further significance for the spread of the disease. There is thus no need for the destruction of such long-dead trees on grounds of disease control, although they may of course pose a safety hazard to passers-by.

Insecticide treatment of elm logs

In some circumstances, particularly where sizeable logs are concerned, spraying of the bark with the insecticide lindane (gamma BHC) may be a useful alternative to burning. When the logs are not infested with beetles or their larvae at the time of spraying, 0.5 per cent weight/volume should be used. A relatively high percentage of insecticide is used so that the material persists on the log awaiting the arrival of the invading beetles. The choice of diluent for the insecticide will depend on the period of protection required. For autumn and winter treatments up to March, diesel or paraffin oil (kerosene) should be used but for spring and summer applications, water will provide adequate persistence of insecticide deposits.

When the logs have already become infested a lower concentration of lindane, 0.25 per cent weight/volume in diesel or paraffin oil (kerosene) may be used to kill beetles within single logs. Treatment of stacked infested logs however has not proved particularly successful.

Treatments should be applied at the time of felling and certainly before transport away from the site. As lindane is extremely poisonous to fish, great care should be taken to keep the insecticide away from streams and ditches.

Further information on this treatment can be obtained from the Entomology Branch, Forestry Commission Research and Development Division, Alice Holt Lodge, Wrecclesham, Farnham, Surrey.

Control of Root Transmission

It has become increasingly evident during the past few seasons that the fungus is able to spread from tree to tree through connecting

roots. The English elm in hedgerows is particularly vulnerable to this means of spread. It does not normally set viable seed and is propagated either by means of root suckers arising at a distance from the main trunk or by coppice growth from felled stumps. Furthermore the roots of neighbouring elms will graft with one another.

Root transmission of Dutch elm disease has been recognised in the United States of America and there, in some areas at least, more than half the trees killed by the disease became infected via their roots. It is clearly important that cognizance should be taken of root transmission and control methods applied to deal with this where appropriate.

In general root transmission can be expected to occur when trees are less than thirty feet apart, although this will depend to some extent on the size of the tree. The basic principle of control involves severing the root connection between one tree and its neighbour. This can be achieved either by mechanical severance, using a trench digging machine, or by application of a chemical sterilant along a narrow band to form a barrier of dead roots through which the fungus cannot pass.

Mechanical Severance

There are many types of machine which can be used to dig a trench between neighbouring trees; the most suitable is one used for laying small pipes or cables. These machines will sever roots in a narrow trench 2-4 inches wide and should reach a minimum depth of 2 feet. The trench line should be mid-way between an infected tree and its healthy neighbour(s) and should extend at least to the 'drip-line' of the trees, i.e. to the line along which rain drips from outermost branches. It should be established as soon as possible after infection appears, and to ensure effective isolation a second barrier should be created between the healthy tree and its healthy neighbour.

This technique cannot of course be used where there is a danger of cutting through service pipes as in an urban area, and is more suited to a parkland or rural situation.

Chemical Treatment

The treatment works on the principle that the Dutch elm disease fungus is unable to spread through dead roots. Instead of a trench between infected trees and their neighbours, a line of holes about 1 inch diameter, 2 ft deep and 6 inches apart is drilled with a soil auger (see Figure 3.). The chemical used to kill the roots is the soil sterilant metham-sodium, and this should be diluted 1 part metham-sodium with 4 parts water. The solution should be carefully poured from a jug and through a funnel into each of the holes to within 1 inch of the top. The hole should then be sealed with soil or turf.

The chemical will kill any vegetation, including turf, in a strip about a foot wide along the barrier. Great care must be taken not to place the barrier too close to healthy trees. Trees within 6 feet of the treatment line are likely to be affected and possibly killed by the chemical. As in the case of mechanical severance a double barrier should be instituted, one between the infected tree and its neighbour and one beyond the healthy tree to ensure successful treatment. It is important that the treatment is applied as soon as possible after symptoms are observed.

The infected tree should not be felled for at least two weeks after treatment in order to give time for the chemical to be effective. Prior removal may accelerate root transmission of the disease.

Pruning

If the disease is localised in a single branch it may be possible to remove it by prompt pruning. However as the fungus is normally well in advance of visible symptoms the pruning cut should always be made several yards away from the signs of disease. The most suitable action may often be to remove the branch flush with the trunk.

Fungicide Injection

The use of fungicides, particularly benomyl, for the control of Dutch elm disease has recently aroused considerable interest. Re-

Chemical control of root transmission

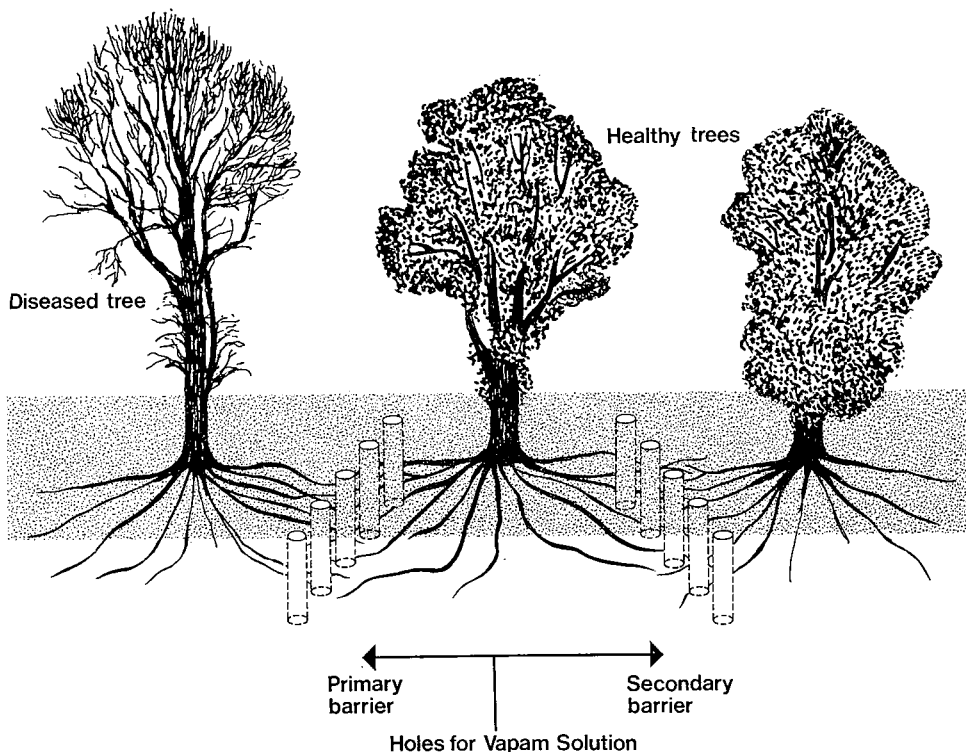


Figure 3. Chemical treatment to check the transmission of Dutch elm disease through tree roots. (Vapam is the trade name of the formulation of metham-sodium used in Forestry Commission experiments)

search work in North America and Britain has shown that such materials can be injected under pressure into the trunk of elms so that the fungicide is well distributed throughout the outer sapwood of the trunk and branches. Such treatment has considerable promise for preventing the infection of healthy trees and perhaps also the further development of the disease in those showing slight infection.

There are however a number of limitations to this technique. Treatment can last only one year and thus may need to be repeated several times. In addition there is no evidence that fungicide injection will prevent infection entering through the root system or cure the

disease in those trees where infection has a firm hold. Details of fungicide formulation and concentration have yet to be determined. The latest information on research into this aspect of the disease can be obtained from the Pathology Branch, Forestry Commission Research and Development Division (for address see p. 4).

Insecticides on Healthy Trees

In the United States the spraying of insecticides has been practised for many years to protect healthy elms from the maturation feeding activities of the elm bark beetles. DDT was originally used but this has now been replaced

by methoxychlor, a chemical which is much less toxic to mammals and birds. Somewhat conflicting reports on the efficacy of methoxychlor have been published and research on the use of this insecticide is now in progress in Britain. However because of the environmental problems associated with the spraying of large trees, it is at present envisaged that insecticides will only have a limited use in the control of the disease here. Some research has also been conducted on the use of systemic insecticides but as yet no successful treatments have been developed.

Summary

Where disease levels are low, the emphasis must be on the destruction of sources of infection. Where disease levels are high, a number of techniques may be considered, many of them relatively new and unproven. On present evidence it appears that fungicide injection offers the best hope of success, coupled if appropriate with prompt pruning and measures to control root transmission.

The Dutch Elm Disease (Restriction on Movement of Diseased Elms) Order 1974

(S.I. ~~809~~ ⁷⁶⁷ HMSO 9p)

This order prohibits the movement of diseased elm wood, unless the bark has been removed or treated with insecticide by a prescribed method, in parts of Britain where disease levels are still low. Details of the

Order, and the scheduled area in which this restriction does *not* apply, can be obtained from the Forestry Commission, 25 Savile Row, London W1X 2AY.

Powers of Inspection and Control by Local Authorities

Eligible local authorities in parts of the country where felling still offers some prospect of controlling the disease may in certain circumstances apply to the Forestry Commission for powers to supplement local action on a voluntary basis.

A person authorised by a local authority with such powers may enter land and inspect elm trees, standing or felled, and may take steps extending if need be to the destruction

of the trees to prevent the spread of the disease. If there are infected elm trees on any land the occupier or other responsible person may be served with a Notice by the Local Authority requiring the destruction of the whole or part of such trees and the taking of steps to prevent the spread of the disease. Failure to comply with such a Notice is a penal offence.

Published by Her Majesty's Stationery Office
Government Bookshops

49 High Holborn, London WC1V 6HB
13a Castle Street, Edinburgh EH2 3AR
41 The Hayes, Cardiff CF1 1JW
Brazennose Street, Manchester M60 8AS
Southey House, Wine Street, Bristol BS1 2BQ
258 Broad Street, Birmingham B1 2HE
80 Chichester Street, Belfast BT1 4JY

*Government publications are also available
through booksellers*