**Climate pins down dreaded tree disease**

**IMAGES AVAILABLE ON REQUEST**

Trees saved by bad weather. It isn’t an often-heard claim. Yet, scientists are suggesting this could be exactly what has happened on the Isle of Man with research, newly-published in the New Journal of Botany, indicating that thousands of healthy elm trees on the self-governing dependency have avoided infection by Dutch elm disease thanks to the island's weather being too cold and windy for the pathogen to take hold.

 The island has an estimated 300,000 elms and only around one per cent of them have been lost to Dutch elm disease since the fungal pathogen was first noticed on the Island in 1992. This is a very different picture from that seen on the British mainland, where the disease has eradicated between 25-75 million trees since the 1970s.

 "The weather appears to be the key to understanding the remarkable survival of these elms thanks to the way it controls dispersal of the beetles that spread disease," said Dr Max Coleman of the Royal Botanic Garden Edinburgh (RBGE). “Dutch elm disease is a fungus that hitchhikes on the bodies of tiny elm bark beetles and is completely reliant on them to get from tree to tree. These beetles are fairly harmless to the tree on their own. However, when they are covered in spores of the deadly fungus they can potentially infect healthy trees.

 “We know the beetles need a temperature of at least 20 degrees to fly and if wind speed exceeds five metres per second flight is inhibited. By analysing local weather data from 1995 to 2015 we found that only one year out of 20 could be regarded as a good year for the beetles and the disease to spread".

 Another possible explanation had been that the island's elms are naturally resistant to the disease. However, the newly published study has ruled this out using the genetic analysis technique of DNA fingerprinting. This has conclusively identified many of the island's elms as a cultivated type known as *Ulmus* x *hollandica* 'Major', also known as Dutch elm. The presence of many individual elms of this type has been central to understanding how the island's elms have survived. "We know that this particular elm is highly susceptible to Dutch elm disease" explained Coleman. "The abundance and survival of the ‘Major’ elm demonstrates that disease resistance alone cannot explain the unusually slow spread of disease".

 The 'Major' elm is an example of what has been called a fashion or nurseryman's elm. Such trees are a single genetic individual that becomes widespread because plant nurseries reproduce them in large numbers by taking cuttings or by grafting. Both techniques create clones that are genetically identical copies of the original tree. The absence of genetic variation makes cloned trees particularly vulnerable to pests and diseases. Once a constantly evolving pathogen has overcome the defences of a clone all individuals of that clone are vulnerable.

 The findings of the research have major implications for the future of elms on the Isle of Man: "Understanding that the island's elms are likely to be just as vulnerable as elms elsewhere highlights the importance of measures to control Dutch elm disease" said Dr Philippa Tomlinson, BSBI County Recorder for the Isle of Man and of Manx Biodiversity, the partnership organisation that provides a biological records service to the Isle of Man Government. "Although the cooler and windier conditions experienced on the Isle of Man appear to have kept disease at bay, this cannot be relied upon in the future with the uncertainties of climate change," she stressed.

Ian Denholm, Editor-in-Chief of *New Journal of Botany*, concluded: “Combining research on elm genetics with consideration of beetle ecology has led to a convincing and elegant explanation of why the spread of disease has been constrained in the Isle of Man compared with much of the UK. Such inter-disciplinary studies highlight the extreme importance of understanding how climate affects interactions between organisms as well as its impact on individual species. Elms are a complex group; unambiguous identification of types present also helps ensure the accuracy of [BSBI’s database of plant records](http://bsbi.org/maps-and-data) encompassing the whole of Britain, Ireland, Isle of Man and the Channel Islands.”.

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 EDITOR’S NOTES:

**The 'Major' elm** is thought to have become popular in Britain after the accession of William of Orange in 1689, who established a protestant monarchy in Britain when he deposed his Catholic uncle James II of England and James VII of Scotland. William grew up in Holland so the planting of this type of elm, originating from Holland, may have been viewed as a patriotic act and it is possible this helped to spread it throughout Britain. The point at which this elm reached the Isle of Man remains unknown.

 In addition to introduced elms, the Isle of Man has a native population of wych elm *Ulmus glabra* that arrived after the last Ice Age around 9,000 years ago, based on pollen samples from datable deposits.

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The paper can be found at:

<http://www.tandfonline.com/doi/full/10.1080/20423489.2016.1271612>

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