

## YOUR LETTERS...

# Intercontinental spread of tree diseases: a cautionary tale from Italy

Dear Editor,

In his article *Online game changer for tree health* (*Scottish Forestry* 71(1) 2017) Max Coleman poses the question: "Should we shut down trade to protect our trees?" His answer is emphatic: "No. We can't ignore globalisation if we value shared prosperity".

It would not be unreasonable to assume that Mr Coleman thinks trade should continue as it is. In my opinion, that would be a fundamental and, in the long term catastrophic, mistake. Is this my idea? No. It has been proposed by many pathologists, most notably by Professor Clive Brasier, Emeritus Pathologist at Forest Research, who has written widely and consistently, warning of the dangers of importing plants and soil, but with limited impact it seems. In 2005, in an article in *The Plantsman* (March, pp 54-57) he advocated, among other measures:

- Regulating plant introductions far more stringently
- Importing, under license only, meristem cultures or seed for propagation
- Encouraging local commercial propagation of exotic forest trees, shrubs or ornamentals.

By 2012, his message was even bleaker: "Unfortunately present international plant health protocol... has failed to provide an acceptable level of protection against the export and import of exotic pathogens; and failed to educate the public on the issue. In present circumstances, none of the world's tree populations, whether native or introduced, whether natural or the products of sophisticated tree breeding, can be considered secure."

Mr Coleman advocates increased vigilance and the planting of mixtures to ensure resilience. Whilst there is sense in both approaches (albeit little hard evidence to support either) there are other factors at work which may render all such moves as superfluous, as the following worrying account shows.

In the 1980s, workers at the 15,000-acre estate of Castelporziano, 15 miles from Rome, noticed that ancient stone pines were dying in unusual numbers. The estate has been an exclusive, closed hunting ground of popes and kings for centuries. Apart from a few eucalyptus trees, the vegetation is all Italian, a pristine example of a Mediterranean forest.

The death of a few stone pines in the 1980s did not cause concern. However,



Figure 1: Stone pines in Castelporziano killed by *Heterobasidion irregulare*.

by the turn of the millennium, it was clear something unusual was happening: hundreds of trees were dying, both in the park and outside (Figure 1). But nowhere else. Death was caused by a ubiquitous root pathogen, *Heterobasidion annosum* (more commonly known as Fomes or Annosum). This disease, present in Britain, is usually controlled by the application of chemical or biological agents to stumps to prevent the germination of aerial spores. DNA extracted from samples of Annosum fruit bodies from dead and dying trees in Castelporziano were analysed. To their surprise, researchers found elements in the DNA from mitochondria known to be present in North America, but absent from Europe. The North American strain of the pathogen is now known to be a different species, namely *Heterobasidion irregulare*.

Further analysis showed that, by the millennium, "...the Annosum population at Castelporziano is indistinguishable from a natural population in Eastern USA. This indicates that it is well-established, and several decades old." according to Dr Matteo Garbelotto, University of California, Berkley.

It is now clear that the European and North American strains of the fungus co-exist over an area of 100km centred on the Castelporziano. They have extensively

hybridised and produced recombinant spores: the first example between naturally allopatric taxa in the species complex. More surprisingly, the presence of this alien pathogen has increased the susceptibility of Italian stone pine to a shoot blight, by alteration of terpene metabolism, and has been reported also in pure oak stands. Not only that, but famous pines in Rome have been infected by the new species complex (Figure 2).

- So, how and when did the invader get in?
- Airborne spores from North America would not survive the journey.
- No exotic trees have been planted in Castelporziano estate.
- No soil has been imported.
- All lumber imports are subjected to routine quarantine
- No long-distant spread of the pathogen has been reported elsewhere in the world.
- There are no insect vectors.

However, quarantine arrangements were not enforced during one period.

In 1944, American and British forces made a seaborne landing at Anzio, 30 miles south of Castelporziano. The subsequent fighting was brutal. An American unit, the 85th Infantry Division of the 5th Army, stayed in the estate for at least a month

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following the capture of Rome. The amounts of timber used in these campaigns was huge: boxes, tent pegs, ammunition cases, roadways etc (Figure 3). The American forces were brigaded in amongst the trees at Castelporziano to rest and regroup after the battle. Artillery and AA guns were dug in, the gun pits being revetted using wooden military packing cases to hold back the sandy soil. Some of these would, most probably, have come into contact with roots of the surrounding pines. It is presumed that the packing cases were made from freshly-felled pine, probably from the southern and eastern states of the US and pressed into service without seasoning. Given transport across the ocean in damp holds, any decay within the timber from the time of felling would probably have survived. Fungal growth out of the packing case revetments and into standing Italian pine seems unlikely, but in theory it could have happened. Once established in the roots of the Italian pine, the American strain of the fungus would have thrived, growing through the roots and eventually killing the affected trees.

A sporophore (fruit body) would grow on the dead tree, from which 'alien' spores were released. These, in turn, infected freshly-cut pine stumps during routine thinning operations after the war. These stumps would also have been infected by the local, European strain of the pathogen, and it is at this site that a hybrid might have spontaneously arisen.

What happens next as the three strains spread in Italy is unpredictable, because it is

## “The exchange of pathogens has increased as a direct consequence of globalisation and the reduction in time it takes to move plants long distances”

unprecedented. But by analogy with other diseases imported across oceans, the outlook is bad for Europe. It should be noted that *Heterobasidion irregulare* has been included by the European and Mediterranean Plant Protection Organisation in the A2 list of organisms recommended for regulation in Europe. Migration of plant pathogens from one continent to another often cause epidemics of untold ferocity. This is because the host plants in the receiving country have not been able to develop resistance to the new pathogen: a slow, Darwinian process that, in mature ecosystems, may have taken thousands of years to develop. The world's continents are, for the most part, separated from each other by oceans too wide for fungal spores to cross. By moving plants and soil quickly between continents, the spread of alien diseases is encouraged.

This exchange of pathogens has increased as a direct consequence of globalisation and the reduction in time it takes to move plants long distances. One example out of many is ash dieback: the importation of one or two

ash trees from Japan into Poland in the last century has been hypothesised to result in the extinction of ash in Europe.

No matter the platitudes of governments that they can control and predict the spread of pathogens by means of inspection and passports, and that they can produce lists of known plant pathogens they wish to exclude, there are always surprises that cannot be predicted (such as ash dieback). What the Castelporziano outbreak of *Heterobasidion irregulare* also teaches us is that pathogens can lie dormant but latent for tens of years before they become manifest. The Italian authorities are virtually powerless to prevent the spread of this new European pathogen, largely because of the cryptic nature of its movement which is partially underground. No amount of vigilance could have foreseen the unlikely and unfortunate sequence of events that have led to this outbreak, which serves as a potent cautionary tale about the movement of plants or plant material between continents.

It can be argued that the Castelporziano case is different because it may have involved the movement of diseased timber rather than live plants, and that is true. However, the principle stands that moving live organisms between continents is risky. In my opinion, Brexit offers us a single opportunity to change our plant health regulations and follow the precept of Professor Brasier, and restrict all imports of live plants to axenic cultures.

Jim Pratt, West Linton



Figure 2: Pines in the Roman landscape: Hadrian's Villa, 19 miles east of Rome.

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**Figure 3:** War material being unloaded by the Allies during the Second World War.

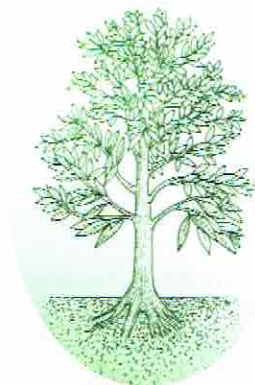
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