

# Pest and disease conquer the horse chestnut

Dr Terry Mabbutt reports on the bleak future for one of our iconic trees

**White flowering horse chestnuts (*Aesculus hippocastanum*) are iconic trees, not native but with a long, distinguished and healthy UK pedigree.**

That was until the first few years of the new millennium when the species was hit in quick succession by an alien insect pest and an exotic disease, which essentially sealed their fate after some 500 years as top amenity and landscape trees in the UK. White flowering horse chestnut has consistently been planted for beautiful candelabra like blossoms and its well-shaped canopy frequently used in avenue tree planting. Fruits and seeds (conkers) have provided enjoyment for countless generations of children.

White flowering horse chestnut is native to a broad swathe of south-eastern Europe and Western Asia, having being introduced from Turkey during the middle of the sixteenth century. The less common but equally fine looking red flowering horse chestnut (*A. x carnea*) is a naturally evolved hybrid between white flowering horse chestnut and a related North American horse chestnut (red buckeye – *Aesculus pavia*), the original hybridisation probably taking place in Germany in the early 1800's.

Until recently both were popular trees for planting in all sorts of amenity, landscape and sporting situations including golf courses. However, virtually no horse chestnut is now being planted due to activity of the horse chestnut leaf miner, which although not fatal ruins the summer canopy of white flowering horse chestnut, and bacterial bleeding canker a bark

RIGHT: Horse chestnut 1. White flowering horse chestnut



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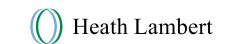
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disease fatal to both white and red flowering horse chestnut.

Greenkeepers with horse chestnut trees on their golf courses will have undoubtedly noticed these problems and may have already been forced to prune and even fell affected trees. However, there is widespread confusion about the different symptoms and ultimate effects caused by horse chestnut leaf miner and bacterial bleeding canker and what can actually be done to avoid and alleviate these problems if and when they arise.

#### Horse chestnut leaf miner

Horse chestnut leaf miner (*Camraria ohridella*) first appeared on white flowering horse chestnut trees on Wimbledon Common (south west London) soon after the dawn of the new millennium having entered the UK as the overwintering pupa stage inside dead horse chestnut leaves attached to the wheels of cross channel road traffic.

Its appearance was not surprising the insect having spread across Europe from its native Balkans (e.g. Macedonia and Greece) in less than 15 years. Once in the UK the insect spread rapidly with well-known golf courses in London Boroughs like Richmond, Merton and Kingston among the first to experience this new insect pest problem.

Within several years it had spread out of London across southern England and into East Anglia and the Midlands. The insect is still spreading and has now reached as far as Cornwall, West Wales and the Scottish borders. However, infestations occurring in the more northerly areas of the country are apparently held in check by cooler summer temperatures not allowing as many generations of the insect and the build-up of pest populations in the canopy.

The tiny adult moths with white and brown barred wings hatch in late April from pupae which



**TOP LEFT: Horse chestnut 2.**  
Red flowering horse chestnut

**LEFT: Horse chestnut 3.** Adult leaf miner moths aggregating on the trunk for mating in late April

**TOP RIGHT: Horse chestnut 3A.** Tiny adult leaf miner moths are hardly visible to the naked eye

**MIDDLE RIGHT: Horse chestnut 3B.** Canopies affected by leaf miner gradually dry out and brown from the bottom up through the summer months

**BELOW RIGHT: Horse chestnut 3C.** Mined areas of horse chestnut leaves are white and bleached like at first



have overwintered in fallen horse chestnut leaves under and around the tree. Both male and female moths aggregate on the tree trunk where they mate, the females flying to the nearest foliage where eggs are laid on the undersides of the newly emerged horse chestnut leaves. Hatching larvae bore into the leaf and proceed to mine the tissues, systematically eating the chlorophyll-rich palisade and spongy mesophyll packed between the upper and lower epidermis (outer layers) of the leaf.

Mined areas of the leaf initially turn white as if bleached then progressively dry out and turn brown in the sun. Having lost their turgor (pressure exerted by water in living cells), tension and physical integrity they eventually roll up inwards to resemble crisp brown brandy snaps still attached to the tree. Several generations of the pest develop through the spring and summer, especially in southern England, gradually moving up through the canopy to mine unaffected green leaves. The larvae are very small and cannot be seen with the naked eye but if you hold an affected leaf up to the light and view from the underside you will see the insect frass (excreta) deposited by larvae in the mined and bleached area of the leaf.

By August, when trees should still be in full green leaf, the canopy looks as though it has been scorched by fire. Leaf miner is not fatal but brings the green canopy to an early end in late summer thus destroying one of the main reasons why white flowering horse chestnut is preferred and selected over many others as an amenity and landscape tree.

Leaf miner only affects white flowering horse chestnut there being a chemical in the leaves of red flowering horse chestnut, inherited from the red buck-eye parent, which prevents the growth and development of larvae hatching from eggs laid on this tree species.

### Bacterial bleeding canker

Bleeding canker caused by several species of *Phytophthora* (a fungus like pathogen) had affected white and red flowering horse chestnuts for many years but was sporadic and slow moving and in no way a threat to trees on a large and long term scale. However, soon after the horse chestnut leaf miner appeared in south west London in 2003 plant pathologists at Forest Research (the research arm of the Forestry Commission) started to find similar bleeding canker

symptoms but on a much larger and wider scale.

The causal pathogen of this new disease was clearly much faster spreading between trees. What's more it moved much more quickly in the bark, rapidly girdling affected main branches and trunks to the extent that full grown horse trees could be dead within several years.

Research finally isolated and identified a bacterium (*Pseudomonas syringae* pv. *aesculi*) as the causal pathogen. This had only previously been recorded in India as a very minor leaf spotting problem on Indian horse chestnut (*Aesculus indica*). Bacterial bleeding canker is fatal to both white and red flowering horse chestnut trees, the latter apparently more susceptible to infection and succumbing more quickly due to its much thinner and less robust bark.

Bleeding lesions (cankers) with widely spaced drops of yellow-brown, rust-red or even black gummy fluid exuding from affected areas of bark on the stem or branches are usually first symptoms of the disease. At the start of the growing season the ooze is dark coloured but still transparent. As the temperature rises through late spring and early summer more bleeding occurs with increasingly rusty red and cloudy/opaque ooze running down the stem. During dry summers the ooze dries out to leave a dark-coloured and brittle crust near the point of exudation. Bleeding may resume in autumn indicating highest pathogen activity under milder moister conditions.

Bleeding cankers caused by *Pseudomonas syringae* pv. *aesculi* vary widely between trees in extent, frequency and position on the trunk (bole) and/or branches. Most bleeding occurs during mild wet periods during spring and autumn. Ooze may dry up in summer on one side of the tree only, depending on aspect, air temperature and light and heat from the sun. Bleeding cankers may appear anywhere from root flares at the collar to positions high up on the scaffold branches. And especially in the forks of main branches which are ideal traps for the bacterial cells as well as taking longer to dry out after rainfall.

Disease and symptoms are cumulative. Within two to three years the fungus grows through the inner living bark (phloem and cambium) on multiple bleeding cankers which coalesce to girdle the branch or bole, cutting off vital functions above and below. At this point foliage starts to yellow and the crown



**BOTTOM LEFT: Horse chestnut 3D.** By late summer the leaves are completely dry, brown and rolled up to look like 'brandy snaps'.

**LEFT: Horse chestnut 4.** Active bacterial bleeding canker on a red flowering horse chestnut tree

**ABOVE: Horse chestnut 5.** Infections caused by the bacterial bleeding canker pathogen commonly occur in the forks formed between scaffold branches and the trunk



thins out. Large parts of the canopy fail to re-foliate in spring and the remaining leaves yellow and drop prematurely as the tree dies.

Affected trees become 'stag-headed' and may require severe pruning or felling in sensitive situations. Horse chestnut wood is inherently soft, moist and fractures easily when compromised. Dead phloem (inner bark) will show as a watery orange brown necrosis distinctly mottled and zoned and the wood (xylem) underneath may have stained blue black. Fungal mycelium visible under dead and dying bark is usually that of the honey fungus (*Armillaria*) invading diseased and weakened horse trees as a secondary pathogen. *Armillaria* can attack healthy trees to cause stem bleeding but only as a root or collar invader.

Bacterial bleeding canker can now be found on horse chestnut trees throughout the United Kingdom including Scotland.

#### Advice to greenkeepers

First realistic advice to greenkeepers is not to plant anymore white and red flowering horse chestnuts. Leaf miner which doesn't affect red flowering horse chestnut and is not fatal to white flowering horse chestnut is not an insurmountable problem but at the moment bacterial bleeding canker essentially is and for both white and red flowering horse chestnut trees.

Diagnostic kits called Lateral Flow Devices are available to determine whether bleeding canker symptoms are in fact caused by *Pseudomonas syringae* pv. *aesculi* or less pressing and serious *Phytophthora* pathogens. A positive result indicates the presence of a *Phytophthora* while a negative result, by default, is strongly indicative of bacterial bleeding canker. All trees including horse chestnuts may sometimes exhibit stem bleeding which has nothing to do with disease.

Greenkeepers should not preemptively fell healthy trees but certainly check horse chestnut trees mainly for bacterial bleeding canker but also leaf miner throughout the year every year. There is no immediate need to fell a tree showing bleeding canker symptoms because there is strong evidence to suggest that some trees are overcoming infections by vigorous production of bark wound tissue which surrounds, isolates and eliminates the infection.

Trees showing early signs of disease and indeed healthy ones may benefit from specific management

practices, in addition to good all round tree care. This includes use of soil de-compaction to alleviate physiological stress and the application of phosphonates which are fertilizers with claimed additional disease protection benefits through inducing trees to produce natural anti-fungal and anti-bacterial chemicals.

However, these chemicals do exist as dedicated fungicide products approved for use in plant nurseries and other situations but not on horse chestnut trees in amenity and landscape situations. Greenkeepers wishing to utilise the fertiliser benefits of phosphonates to bolster tree growth, health and protection should consult their supplier or a professional arborist to make sure they stay within current PSD guidelines.

Trees with active bacterial bleeding canker, and especially those with advanced symptoms including branch die-back, should be monitored carefully and be pruned or even felled accordingly.

Leaf miner infestations occurring year after year clearly weaken trees and almost certainly reduce the amount and quality of fruit and seed (conkers). However, leaf miner infestations are not fatal unless associated with something else that is. Individual trees can be protected to a large extent by clearing up and destroying all shed horse chestnut tree leaves in autumn. With no dead leaves under or around the tree there are no pupae for continuity of pest infestations into the following spring and summer.

The pest will invariably return but can be kept at minimum levels by clearing up and destroying fallen autumn leaves every year. Burning the leaves is the quickest and safest option providing it does not infringe Environment Agency Regulations. Greenkeepers unable to or not wanting to burn leaves for whatever reason can make sure all pupae are killed by deep layer composting, the leaves achieving a sufficiently high temperature during rotting to kill any leaf miner pupae inside.

Those who still want to plant horse chestnuts could do worse than trying Indian horse chestnut (*Aesculus indica*), a tree similar in size and stature to white flowering horse chestnut and with equally beautiful blossoms.



**ABOVE: Horse chestnut 6.** Horse chestnut wood is already inherently weak and infections with bacterial bleeding canker can cause major tree failure

**RIGHT: Horse chestnut 7.** Advanced infection with major bark cracking, sloughing and loss on a red flowering horse chestnut tree

**BELOW: Horse chestnut 8.** Leaf miner and bacterial bleeding canker significantly reduce both the yield and quality of 'conkers'

