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 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 (Cameraria 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 form pupae which Dr Terry Mabbutt reports on the bleak future for one of our iconic trees

This article comes to you courtesy of the BIGGA Learning and Development Fund.

Thankyou to all our key sponsors

Silver Key Sponsors

Gold Key Sponsors

TOP LEFT: Horse chestnut 2. White 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 leaves then eventually fall through the autumn months
BELOW RIGHT: Horse chestnut 3C. Mined areas of horse chestnut leaves are white and bleached like at first

40 OCTOBER 2012
41 OCTOBER 2012
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 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 (Cameraria 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 form pupae which
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.

Minced areas of the leaf initially turn white as it bleaches 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 leaves which snap up 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 a 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 other trees as an amenity and landscape tree.

Leaf miner only affects white and red flowering horse chestnut but not the red buck-eye (Aesculus sepulchralis) as it has a robust bark.

Bacterial bleeding canker

Bleeding canker caused by several species of Phytophthora (fungus-like pathogens) had affected white and red flowering horse chestnut 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 phenomenon was clearly much faster spreading between trees. What’s more it moved much more quickly in the bark, rapidly getting affected main branches and trunks to the extent that full grown trees could be dead within several years.

Research finally isolated and identified the bacterium (Pseudomonas syringae pv. aesculi) as the causal pathogen. This had only previously been recorded in India. Fungus is a very minor leaf spotting problem on Indian horse chestnut (Aesculus indica) due to the distinctively mottled and anoded and the wood (xylem) under bark under moist conditions. Aralia can attack healthy trees to cause stem bleeding but only as a root rot. 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 to look for typical symptoms of the disease. At the start of the growing season the outer tree ring is dark brown but remaining green. As the temperature rises through late spring and early summer more brown leaf development occurs with increasing red and cloudy/opaque outer running down the stem. By early summer the outer dries out to leave a dark-coloured and brittle coat near the point of exudation. Bleeding may resume in autumn indicating highest pathogen activity under milder moister conditions.

Bleeding canker symptoms are caused by Pseudomonas syringae pv. aesculi an organic acid bleaching canker pathogen causing a straw to cream to brown discoloration of the leaves. This is particularly obvious in the autumn as the leaves thicken and thins out. Large parts of the canopy fail to re-foliate in spring and the remaining leaves yellow and drop prematurely. Affected trees become ‘stagnated’ and may require severe pruning. Areas of bleeding canker are in many cases dead and cannot be used for planting. However, these chemicals are toxic to beneficial bacteria and copper products are approved for use in plant nurseries and other situations where there is no horizon of leaf, amenity and landscape situations. Greenkeepers wishing to utilise the cultural benefits of phosphates 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 filled according to disease activity. Leaf miner infestations occur year after year on these trees and almost certainly reduce the amount and quality of fruit and seed production. Horse chestnut leaf miner infestations are not fatal unless associated with another disease that is. Individual trees can be protected to a large extent by clearing up and destroying all shed horse chestnut leaves in autumn. With no dead leaves under or around the tree the pest cannot complete its larval stages. By removing dead leaves in autumn there is no chance of repeat infestation into the following spring and summer.

The pest will invariably return but can be kept at minimum levels by clearing up and destroying all shed horse chestnut leaves in autumn. However, these chemicals are toxic to beneficial bacteria and copper products are approved for use in plant nurseries and other situations where there is no horizon of leaf, amenity and landscape situations. Greenkeepers wishing to utilise the cultural benefits of phosphates 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 filled accordingly.

Leaf miner infestations occur year after year on these trees and almost certainly reduce the amount and quality of fruit and seed production. Horse chestnut leaf miner infestations are not fatal unless associated with another disease that is. Individual trees can be protected to a large extent by clearing up and destroying all shed horse chestnut leaves in autumn. With no dead leaves under or around the tree the pest cannot complete its larval stages. By removing dead leaves in autumn there is no chance of repeat infestation into the following spring and summer.

The pest will invariably return but can be kept at minimum levels by clearing up and destroying all shed horse chestnut leaves in autumn. However, these chemicals are toxic to beneficial bacteria and copper products are approved for use in plant nurseries and other situations where there is no horizon of leaf, amenity and landscape situations. Greenkeepers wishing to utilise the cultural benefits of phosphates 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 filled accordingly.

Leaf miner infestations occur year after year on these trees and almost certainly reduce the amount and quality of fruit and seed production. Horse chestnut leaf miner infestations are not fatal unless associated with another disease that is. Individual trees can be protected to a large extent by clearing up and destroying all shed horse chestnut leaves in autumn. With no dead leaves under or around the tree the pest cannot complete its larval stages. By removing dead leaves in autumn there is no chance of repeat infestation into the following spring and summer.

The pest will invariably return but can be kept at minimum levels by clearing up and destroying all shed horse chestnut leaves in autumn. However, these chemicals are toxic to beneficial bacteria and copper products are approved for use in plant nurseries and other situations where there is no horizon of leaf, amenity and landscape situations. Greenkeepers wishing to utilise the cultural benefits of phosphates 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 filled accordingly.

Leaf miner infestations occur year after year on these trees and almost certainly reduce the amount and quality of fruit and seed production. Horse chestnut leaf miner infestations are not fatal unless associated with another disease that is. Individual trees can be protected to a large extent by clearing up and destroying all shed horse chestnut leaves in autumn. With no dead leaves under or around the tree the pest cannot complete its larval stages. By removing dead leaves in autumn there is no chance of repeat infestation into the following spring and summer.

The pest will invariably return but can be kept at minimum levels by clearing up and destroying all shed horse chestnut leaves in autumn. However, these chemicals are toxic to beneficial bacteria and copper products are approved for use in plant nurseries and other situations where there is no horizon of leaf, amenity and landscape situations. Greenkeepers wishing to utilise the cultural benefits of phosphates 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 filled accordingly.
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.

Minired 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, brassy 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 (screw) deposited by larvae in mined and bleached areas 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 a fatal disease but brings the green canopy to an early end in late summer thus destroying one of the main aspects, air temperature and light which coalesce to girdle the branch or bole, cutting off vital functions which eventually fall inwards to the inner living bark (phloem and cambium) on multiple bleeding cankers forming between scaffold branches and the trunk.

Leaf miner only affects white flowering horse chestnuts but this being a chemical in the leaves of red flowering horse chestnut, inherited from the red back-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 fungal 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 identified in woodland by the phloem (inner bark) of red flowering horse chestnut, being a chemical in the leaves of red flowering horse chestnut, thus destroying one of the main aspects, air temperature and light 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 thins out. Large parts of the canopy fail to re-foliate in spring and the remaining leaves yellow and drop prematurely as the disease has caused much faster spreading between trees. What’s more it moved much more quickly in the bark, rapidly devastating main branches and trunks to the extent that full grown trees could be dead within several seasons.

Research finally isolated and identified the bacteria (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) are 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 symptomatic of this 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 reddish fluid exudes with an almost rusty red and cloudy/opaque ooze running down the stem. During dry summers the ooze dries out leaving 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 are widely host specific in trees in extent, frequency and position on the trunk (bole) and/or branches. Most bleeding occurs during mild wet periods during spring and autumn. Oozes 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 links of main branches which are thinner and do not provide enough physical support to make sure they stay within current growth practices, in addition to good all round tree care. This includes use of soil de-compost to alleviate the deleterious ulation of phosphonates which are fertilizers with claimed additional granular benefits of phosphates and cotinine to induce trees to produce natural anti-fungal and anti-bacterial substances. However, these chemicals are also unfortunately the cause of problems as they elicit toxic and non-toxic reactions in plants.

**Advice to greenkeepers**

First realistic advice to greenkeepers is to find similar bleeding canker symptoms on white and red flowering horse chestnuts. Leaf miner which does not affect flowering red chestnut and is not fatal to white flowering horse chestnut is not an insurmountable problem but at the moment bacterial bleeding canker sees it as fatal. Evidence of bacterial bleeding canker symptoms are in fact caused by *Pseudomonas syringae pv. aesculi* or less pressing and serious *Phytophthora* many others. A positive result indicates the presence of a *Phytophthora* while a negative result indicates the presence of a *Bacterial bleeding canker*. All trees including horse chestnut may suffer with fungal bleeding canker symptoms but only VCF can make sure all pape wood is killed by deep layer composting, the leaves achieving a sufficiently high temperature during rotting to kill off any leaf miner pupae inside.

Trees that still want to plant horse chestnut could do worse than opting for a VCF Indian horse chestnut (Aesculus indica), a tree similar in size and stature to flowering horse chestnut and with equally beautiful blossoms.