Differentiating *Anoplophora* longhorn beetle damage from that of native wood-boring insects

PLANT PEST FACTSHEET

Figure 1. Adult Citrus longhorn beetle (body 21-37 mm long)

Background

The Asian longhorn beetle (*Anoplophora glabripennis*) and citrus longhorn beetle (*Anoplophora chinensis*) are serious invasive pests native to East Asia. They are listed in the Plant Health Directive and are therefore regulated in the EU. Both species can infest a very wide range of broadleaved trees and would be a major threat to horticulture and the wider environment if they became established in the UK. The larvae feed undetected inside trees leaving them weakened and susceptible to further pest and disease damage. Most Asian longhorn beetles found to date in the UK have been associated with wooden packaging (dunnage) imported from Asia. Most citrus longhorn beetles found in the UK have been associated with Japanese maple trees imported from China.

Adult Asian and citrus longhorn beetles (Fig. 1) are similar in appearance to one another, but are large and distinctive enough (black with white spots) that they are unlikely to be confused with any other beetles found in the UK (or Europe). The damage caused by the larval feeding and the appearance of the adult emergence holes, however, are similar to damage caused by other wood-boring beetles and moths found in the UK (most notably the large poplar beetle (*Saperda carcharias*) and leopard moth (*Zeuzera pyrina*)). The purpose of this guide is to provide information that can help distinguish adult emergence holes and larval tunnels of *Anoplophora* spp. from other wood-boring insects.

If you suspect the presence of this pest, or see a beetle that you suspect to be Asian or citrus longhorn beetle, trap it if possible and immediately report the finding to your local Fera Plant Health and Seeds Inspector.

Tel: 01904 465625
Email: planthealth.info@fera.gsi.gov.uk
Web: www.defra.gov.uk/fera/plants/plantHealth

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Asian longhorn beetle and citrus longhorn beetle

The larvae of both Asian and citrus longhorn beetles develop in a wide range of broadleaved trees and they share many host species. Common hosts include birch, elm, horse-chestnut, maple, poplar, sycamore and willow.

Larval tunnels

The tunnels are linear, circular in cross-section and located within the pith and vascular layers of the host trunk (Figs 2 and 3). Asian longhorn beetle tunnels occur higher up in the main trunk and in branches in the canopy, whereas citrus longhorn beetle tunnels occur in the lower part of the trunk and in the larger roots. As the larva (Fig. 5) grows the tunnel becomes progressively wider, before a pupal chamber is formed in which the larva pupates (Fig. 6). The presence of the pupal chamber may be indicated by a bulge in the bark. As the longhorn beetle larvae feed they back-fill their larval tunnel with their own sawdust-like waste (Figs 3 and 4) amongst which can sometimes be found cast larval skins and their dark brown sclerotized mandibles. Several tunnels may occur in the same tree. Piles of the sawdust-like waste may collect at the base of infested trees.

Figure 2. Citrus longhorn beetle larval tunnel in *Acer*

Figure 3. Citrus longhorn beetle larval tunnel filled with waste products

Figure 4. Sawdust-like waste products

Figure 5. Citrus longhorn beetle legless larva (up to 50 mm long)

Figure 6. Asian longhorn beetle pupa. The long curled antennae are clearly visible

Figure 7. Asian longhorn beetle emergence holes © Frank Herard

Figure 8. Asian longhorn beetles emergence holes © Mateo Maspero

Figure 9. Citrus longhorn beetle oviposition slit © Mateo Maspero

Figure 10. Feeding damage caused by adult Asian longhorn beetles © Frank Herard

Emergence holes

The emergence holes formed by Asian and citrus longhorn beetles are about 10 mm in diameter and are circular or sub-circular in shape with a slightly irregular edge (Figs. 7 and 8). The shape of the emergence hole is however not diagnostic as most wood boring beetles produce circular emergence holes.

Oviposition slits and adult feeding

In addition to the adult emergence holes and larval tunnels, oviposition slits and adult feeding damage may be observed. The eggs are laid one by one under the bark, in oviposition slits chewed out by the female (Fig. 9). The oviposition slits of Asian longhorn beetle generally occur higher up the tree than those of citrus longhorn beetle. Sap commonly oozes out of the oviposition slits.

Adult Asian and citrus longhorn beetle chew the green bark of new shoots and can cause extensive damage (Fig. 10).

Native wood-boring beetles (Coleoptera)

There are a large number of beetle species present in the UK that have wood-boring larvae, but the majority are significantly smaller than *Anoplophora* and therefore their tunnels and emergence holes are also noticeably smaller. These include many species of ambrosia or bark beetles (*Curculionidae*: *Scolytinae* and *Platypodinae*) and jewel beetles (*Buprestidae*) that tunnel directly beneath the bark, but do not tunnel into the heartwood. The larvae often occur together in large numbers (Fig. 11). Some native longhorn beetles produce symptoms that could be mistaken for those of the *Anoplophora* species but most are much smaller. The longhorn beetle most likely to be confused with *Anoplophora* is the large poplar beetle.

Longhorn beetles (Cerambycidae)

Large poplar beetle (*Saperda carcharias*)

This beetle (Fig. 12) occurs widely in Britain but is rarely recorded. The larvae are found in trunks of aspen (*Populus tremula*) the preferred host, but other *Poplar* species, *Salix* and occasionally *Quercus* may be utilised. The adults emerge during July and August and remain active until October. During the emergence period, frass and wood fibres are ejected through a circular hole in the bark formed by an enlargement of the oviposition site. The larval tunnels (Figs 13-15) and emergence holes are very similar to Asian longhorn beetle.

Figure 11. Bark beetle emergence holes (left) and larval tunnels (right)

Figure 12. Adult large poplar beetle (body 20-30 mm long) © Gyorgy Csoka

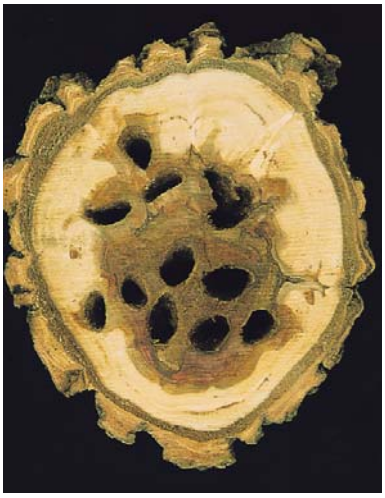

Figure 13. Large poplar beetle tunnels © Gyorgy Csoka

Figure 14. Large poplar beetle larva © Gyorgy Csoka

Figure 15. Large poplar beetle larva and tunnel packed with sawdust-like waste © Louis-Michel Nageleisen

Native wood-boring caterpillars (Lepidoptera)

There are a number of UK species of wood-boring Lepidoptera larvae (caterpillars), which can cause severe damage to trees (Fig. 16). Larvae often spin silk linings in the tunnels, spin frass together with silk, and, depending on the species, form cocoons with silk and chewed wood fibres for pupation. The cocoon is often left just inside the exit hole after adult emergence, and may be pulled out with forceps, or seen by shining a torch into the hole (Fig. 17). Often, upon emergence, the pupal case is left extruded from the exit hole and cocoon, and may last for months. If live larvae are found, they have crochets (a series of small, darkened hooks arranged in lines or circles) on the abdominal prolegs, visible with a hand-lens if the larva is turned upsides down (Fig. 18). Coleoptera larvae do not use silk, do not form cocoons, do not leave pupal cases extruded from the exit holes and never have crochets on abdominal prolegs.

Clearwing moths (Sesiidae)

This is a family of day flying moths, the adults of which are mimics of wasps and hornets and have large transparent areas on the wings. There are 15 species of Sesiidae in the UK, each species with a relatively narrow larval host range. Trees bored by native Sesiidae include species of *Alnus* (alder), *Betula* (birch), *Crataegus* (hawthorn), *Malus* (apple, crab apple), *Populus* (aspen, poplars), *Prunus* (cherries, almonds), *Pyrus* (pear), *Quercus* (oak), *Salix* (sallows, willows and osiers), *Viburnum* (wayfaring tree) and *Sorbus* (rowan). There are a number of other sesiids in continental Europe which might be associated with imported trees, e.g., *Sesia melanocephala*, which bores in and around dead upper branches of *Populus*.

Sesia apiformis (hornet moth) and ***Sesia bembeciformis*** (lunar hornet moth)
The larvae are morphologically indistinguishable, but both are native to the UK. Larvae are pale yellow or cream and heavily wrinkled, with a brown head and no obvious markings on the body except for two darker diagonal marks behind the head (Fig. 19). Larvae reach a maximum length of 30 mm. Both species tunnel in the roots and lower trunk, with *S. bembeciformis* moving up the tree to about 20 cm above ground level in the second year. Both species pupate inside the tunnels and create rough circular exit holes, with an average diameter of 8 mm. Prior to pupation, the larvae tunnel very close to the surface of the wood, leaving only a very thin skin of bark. Scraping the bark of a tree suspected to be infested, or pressing hard in small spots, may reveal soft points where there are occupied cocoons under the bark. There is a difference in host preference between the species. *Sesia apiformis* usually feeds in *Populus* species with other host records including *Salix* and, less often, *Tilia*, *Betula* and *Fraxinus*. *Sesia bembeciformis* is usually found in *Salix* species, but has also been recorded in *Populus* and *Rubus*. Of the 13 other species of Sesiidae found in the UK, all are smaller than the Sesia species covered above, and bore into a variety of tree species. All are very plain coloured larvae, with brown heads and the bodies often yellow or cream but sometimes pink, and with no obvious markings.

Cossidae

The adults are very large and heavy-bodied nocturnal moths. Larvae of two UK species bore into trees: both are polyphagous on broadleaved trees and other woody plants.

Leopard moth (*Zeuzera pyrina*)
The larvae have a cream or yellow body with large black spots all over it (Fig. 20). The head is black or dark brown, and the prothoracic shield behind the head is raised, rough and bumpy. The maximum length is 40-55 mm, and the larvae overwinter 2-3 times. The larvae preferentially bore into side branches rather than the main trunk, and are usually found in branches less than 10 cm across. Pupation is inside the larval tunnels, and the larvae do not always construct a cocoon.

Goat moth (*Cossus cossus*)
These larvae can be huge, reaching a maximum length of 90-100 mm. They have dark red or purple bodies, with black or brown spots (Fig. 21). This species prefers damp wood, tunnelling under the bark as young larvae and moving into the heartwood as they mature, and mostly bore in the main stem. Some larvae leave the wood to pupate nearby in the soil, but others remain in the wood tunnels.

Figure 16. Multiple exit holes in the lower stem of *Populus*, caused by Sesiidae larvae. The exit holes are approximately 8 mm across

Figure 17. Close up of a *Sesia* species exit hole on a cut open section of *Populus* trunk. The vacated cocoon can be seen on the right hand edge (circled), and is made of wood fibres spun together with silk

Figure 18. Ventral view of part of a *Sesia* sp. larva, showing transverse lines of crochets visible on the prolegs (one proleg circled)

Figure 19. Dorsal view of a *Sesia* sp. larva, showing the yellow wrinkled body without obvious markings. The larva is up to 30 mm long

Figure 20. *Zeuzera pyrina* larva, showing the yellow body covered in black spots. The larva is up to 55 mm long

Figure 21. Early instar *Cossus cossus* larva, showing the dark red body with brown-black plates. The larva is up to 100 mm long

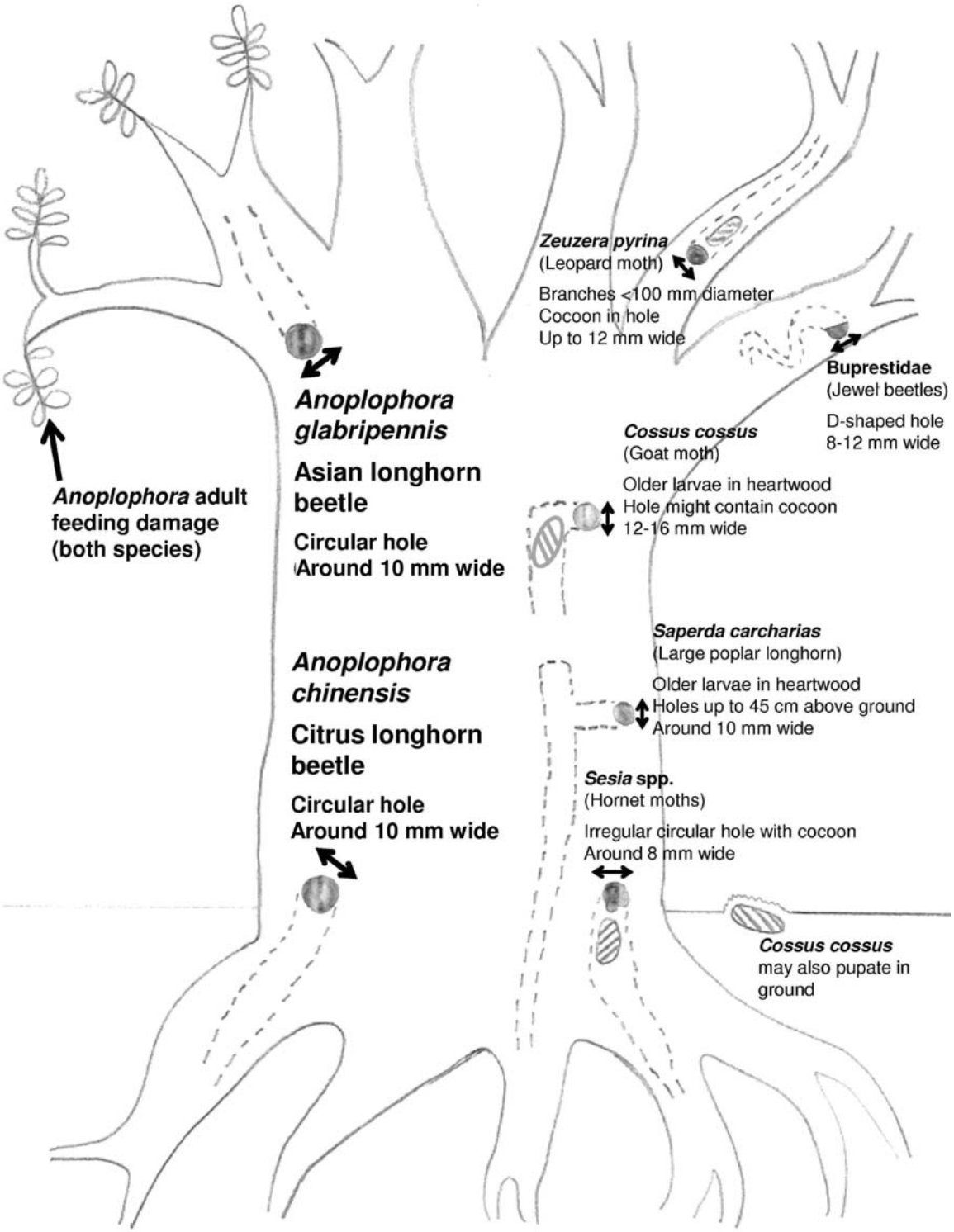

Figure 22. Schematic diagram of a tree showing the usual position of exit holes caused by a variety of wood-boring insect larvae. Individual larvae of any of these species may differ in the size and positioning of holes

Authors

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