

London Tree Officers Association
Oak Processionary Moth - *Thaumetopoea processionea*
(OPM)
Guidance Note



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The LTOA is indebted to the work of the Forestry Commission, Local Government Officers and many individuals for their efforts against the pest and for information contributing to the production of this document. The opinions are those of the LTOA OPM working party.

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EXECUTIVE SUMMARY

This document has been developed as a guide for Local Authorities and other large landowners that may be affected by OPM. Its aim is to advise all those involved with the management of OPM of the history of events and actions that have led us to this position and to inform our future actions.

In **The Preface** we have highlighted a number of issues concerning broad strategy, legislation and other matters which are beyond the remit of any one of the managers referred to above but which we consider essential to be addressed. We have listed the conclusions we consider should be drawn from this. These conclusions are repeated in summary on page 5 **Key Conclusions**.

Part One examines the history of the outbreak and its management and gives a general outline of the considerations that have led the LTOA to the conclusion that this is both a human and plant health problem.

Part Two highlights those inspection and treatment methods that have been used over the last 3 years. This has been set out in a way to assist those tree officers and managers that are starting out in the management of OPM. It does not provide a step by step treatment guide. Given the complexity of the urban context, the versatility of the pest and the variety of control methods, such a convenient short cut is, alas, not possible. Throughout Part Two, however, we have presented our recommendations alongside the data upon which they are based and repeated them in summary on page 14 **Key Recommendations**.

Readers will require background material on chemicals, procedures to protect staff and visitors, disposal of OPM waste, etc, **Appendices** and references are provided to give as much of this information as possible. **This document** will be updated in the light of changes in experience and knowledge. It can be downloaded from the LTOA website (www.ltoa.org.uk)

Here and throughout the document it has been necessary to refer to 'management', 'treatment' and 'control' – all terms which can at times imply the aim of accepting the permanent presence of OPM. We re-iterate; the target is **eradication**.

Key Conclusions

- The human health problems posed by OPM need to be recognised as a significant effect of this pest and appropriate existing legislation, pertinent to a human health issue, activated in tandem with plant health-based measures.
- Plant health measures must remain in place and if necessary, import controls or their enforcement strengthened to prevent further new outbreaks resulting from the importation of infested tree stock.
- In the eventuality of the plant health-based eradication programme failing or being downgraded to a control/containment strategy, appropriate existing legislation, pertinent to a human health issue, will need to be activated.
- The appropriate personnel to operationally manage the outbreak are Tree Officers/Managers under a city wide operational plan.
- Adequate resources should be made available to give an eradication programme a chance of success. This must recognise the issues of privately owned trees.
- If high costs and collateral environmental damage are to be avoided, urgent action is required on the licensing and availability of the most effective treatments.
- If the above cannot be achieved, the LTOA reluctantly concludes that eradication requires the acceptance of such localised collateral damage.

PREFACE

1. The Forestry Commission is lead organisation on OPM in the UK. The relevant statutory instrument is the Plant Health (Forestry) Order 2005. Articles 31 and 32 provide the powers for enforcement. The Commission have issued enforcement notices, undertaken surveying in infested areas, recorded the outbreak and co-ordinated action with the aim of eradication.
 - It is noted that the full effects on Oaks in the UK are unknown but have not included significant tree deaths to date.
 - In Europe there is evidence that in Forestry this pest can lead to a reduction in timber productivity and therefore loss of revenue. Due to the lack of impact on forestry timber production in the UK, OPM is not receiving the resource priority accorded to *Phytophthora* and some other forestry pests. To date funding has been limited and bids for future funds for dealing with plant health have not prioritised OPM sufficiently in the opinion of the LTOA.
 - All currently known outbreaks have been confirmed as originating from imported nursery stock from Europe. This highlights the need for continued application of the plant Health measures (Plant passports).
 - As of the launch date of this document (October 2010) further suspected outbreaks have been reported from Hampton Court, Pangbourne and Oxford. This further highlights the fact that at present these control measures are not succeeding in excluding infested material.
2. The Health Protection Agency (HPA) has made statements in support of the Forestry Commission lead, but has declined to take a pro-active role in the eradication programme or take any action with regard to OPM as a human health hazard.
 - *Thaumetopoea processionea* is therefore, for all *practical* purposes not recognised as a public health issue.
 - In the UK it remains viewed as a relatively minor tree problem whereas in the Netherlands, for example, OPM is considered a human health threat.
3. A lack of recognition of the potential human health issues alongside the plant health aspect has limited the effectiveness of the eradication programme. Perception of the consequences of failure are reduced and the spur to conscience of a public health issue is absent when dealing with some landowners. The legislation in use to enable eradication of OPM is plant health related. This is not appropriate to address the additional human health issues.
 - For instance, no compensation is available under the plant health legislation – unlike the situation with, say, foot and mouth disease. This slows response dramatically.
 - Efforts to eradicate are likely to be unsuccessful with current resources. If this occurs strategies will change to ones of control/containment. This would not only be an acceptance that OPM is here to stay. It could result in a weakening of enforcement action unless there is recognition of the human health aspect alongside that of plant health.

- The LTOA believes that we should recognise the likelihood of arrival at such a situation – perhaps within a short time.
 - Nevertheless the LTOA recognises that Tree Officers/Managers remain the most appropriate personnel to manage operations under a city-wide operational plan.
4. Our efforts to eradicate OPM are also compromised by the limited treatment methods licensed for use in the UK.
- A more effective strain of *Bacillus thuringiensis* (BT) using live bacillus is in use on mainland Europe.
 - Further research is being undertaken into other biological controls that are Lepidoptera specific.
 - The most effective treatment used in the UK involves the use of a non-specific pesticide, which can cause heavy collateral damage among other invertebrates.
 - This highlights the need for fast tracking of the licensing of the most successful treatments. If this, and new products, are successful, eradication could still be achievable in the UK, if not, the LTOA reluctantly concludes that eradication requires the acceptance of localised collateral damage.
5. Efforts at eradication are yet further compromised by lack of resources overall, including the facts of:
- current lack of the pan-London response recommended by the LTOA. At present frontline boroughs are struggling while those yet to be affected contribute nothing but moral support and advice such as this provided by the LTOA.
 - a high proportion of potentially affected trees being located in the private sector where efficient immediate response cannot be guaranteed. Without a solution to this issue, any programme will fail.

In view of all of the above the LTOA therefore comes to certain conclusions to be considered along with the practical operational recommendations found on the following pages:

Conclusions

- The human health problems posed by OPM need to be recognised as a significant effect of this pest and appropriate existing legislation, pertinent to a human health issue, activated in tandem with plant health-based measures.
- Plant health measures must remain in place and if necessary, import controls or their enforcement strengthened to prevent further new outbreaks resulting from the importation of infested tree stock.
- In the eventuality of the plant health-based eradication programme failing or being downgraded to a control/containment strategy, appropriate existing legislation, pertinent to a human health issue, will need to be activated.

- The appropriate personnel to operationally manage the outbreak are Tree Officers/Managers under a city wide operational plan.
- Adequate resources should be made available to give an eradication programme a chance of success. This must recognise the issues of privately owned trees.
- If high costs and collateral environmental damage are to be avoided, urgent action is required on the licensing and availability of the most effective treatments.
- If the above cannot be achieved, the LTOA reluctantly concludes that eradication requires the acceptance of such localised collateral damage.

PART ONE – History of OPM

1.1. The Introduction of OPM to the UK.

Discovery. OPM was first identified in the UK in 2006 on trees at a housing estate in Richmond. It was confirmed following a high incidence of skin rash symptoms among local residents. This triggered the involvement of the London Borough of Richmond-upon-Thames' Environmental Health Section, whose officers brought in an entomologist, confirming the presence of an OPM colony. OPM had arrived at the site on young, newly planted, imported trees, which led to a survey of other imported Cypress Oaks and revealed a further group of infested trees on the A40 at Hanger Lane and an adjacent industrial estate.

Responsibility to date. Having proven that the pest was imported, the Forestry Commission were able to invoke powers under the Plant Health (Forestry) Order 2005, Articles 31 and 32 of which provide enforcement powers. These allow restriction of imports except from nurseries certified free of the pest. They also make it possible to enforce treatment and prevent the movement of potentially infested material. Thus, legally it is the Forestry Commission which enforces all action on OPM at the present time.

These measures apply while the aim is eradication. If OPM becomes established in the UK the aim is likely to change to focus on control/containment, and the current legal tools may be modified in practice.

Spread of the pest has been made easier by the widespread presence of Oak, the presence of 'corridors' such as major road and rail links, large tree collections along the river in the Richmond area and the hugely fragmented property ownership structure. With the mosaic of boundaries, ownerships and responsibilities in the densely urbanised areas it is hard to identify the locations of Oak, let alone the presence of OPM.

Treatments that have been implemented over the course of the outbreak have achieved mixed results. Here we briefly summarise the main points that LTOA members and other parties have discovered whilst treating OPM in the last four years. Part Two deals with inspection and treatment processes more fully.

- Surveying for egg plaques or for larvae before Stage Three is not effective. Note – we refer throughout the document to the growth stages of the caterpillar. The stages or 'instars' are the periods between moults. OPM normally has 6 instars before the pupal stage.
- The extreme difficulty of finding the pest in these early stages highlights the need for the prophylactic (preventative and precautionary) process of re-spraying all trees affected in the previous year again in the following season.
- Spraying with the currently UK licensed ***Bacillus thuringiensis* (BT)** uses the bacterial toxin only and therefore requires multiple applications followed by manual nest removal – a high input strategy.
- Spraying with **Deltamethrine** is more cost effective. However it is only possible where a Local Environmental Risk Assessment for Pesticide (LERAP) has been completed and allows its use.

- Physical removal is labour intensive and only effective as a control measure – although in places it is essential, it will not ensure eradication without complementary spraying/chemical applications.

1.2. Why OPM is a serious problem which must be dealt with urgently.

In this section we summarise the effects of OPM in the urban environment. For detail on the *medical* aspect of the problem, see Appendix 3.

- **People and trees.** The outbreak is still largely in the colonisation phase (see 1.3 below). Failure to eradicate can result in plague levels of the pest. Locally this has been close to occurring with the current outbreak. Such levels of infestation will transform the situation for trees and people.
- **People and trees.** The location of the outbreak at present is a densely populated matrix of public land and private properties, varying immensely in size, occupancy and ownership. Eradication or control measures cannot be undertaken with the same ease that, for instance, could be exercised on large forestry monocultures. One hidden oak in a back garden can be a reservoir of infestation negating all efforts of surrounding landowners.
- **People.** The caterpillar's defence mechanism is the production of a toxin (*thaumetopoein*) that is held in hairs on its body. These urticating hairs cause the rashes and other medical problems referred to in Appendix 3.
- **People.** Direct contact can be by handling the caterpillars and contact with nest material, which retains the hairs from previous instars (growth stages).
- **People.** Direct contact with the pest is not necessary. The hairs are very small and delicate (0.2mm in size), become easily broken or detached from the caterpillar and, carried in air currents, impact on people, pets, livestock, exposed clothing, washing, food, etc, All are vulnerable.
- **People.** High temperatures are required to de-nature the toxins. Normal clothes washing temperatures are not sufficient. It is possible that toxins could be transferred to previously uncontaminated clothes – as is the case with Poison Ivy (*Toxicodendron radicans*) (see notes on decontamination Appendix 4).
- **People and trees.** Oaks can be large and are of widespread distribution. They often exist in inaccessible places or conversely in dense oak-heavy woodlands. As in either case many colonies could escape detection and treatment, the source of the medical problem may also escape notice or be mis-diagnosed (Appendix 3). Long term, sheer numbers of Oaks will make eradication impossible if OPM escapes from the urban area into the wider countryside.
- **Trees.** At plague levels OPM can be a serious tree problem. In a rural woodland or forestry context this could be the main issue. Major defoliation and severe infestations repeated annually on specific trees could have a lasting effect on their health. To date these effects have not been

seen or quantified in the UK due to the current small extent of the outbreak and the active response to it.

- **People – Landowners.** If eradication fails, there will be a special category of need for continued control in areas of high Oak populations with public access or near to population centres. Local Authorities, woodland owners, etc, come to mind as those who will bear continuous heavy costs for the foreseeable future.
- **People and Economy.** The effects on livestock (and pets) are exacerbated by hairs becoming trapped in fur. Horses are particularly sensitive, highlighting possible effects on some leisure economies. In mainland Europe toxins have been found in milk, suggesting effects in agriculture. Possible closures of infested areas to the public would obviously have economic effects on many varied sites – for example, amusement parks, sporting venues and showgrounds.

1.3. Time line and Mapping of UK Outbreak.

OPM has been known as present in the UK for four years. In this time monitoring has been centralised by the FC and data collated to map the outbreak. As with some other 'newly arrived' pests, OPM might follow a population pattern through four main stages; colonisation, establishment, plague and crash. The outbreak overall is still in the colonisation phase, although in years leading up to 2010 in some sites and localities it had reached establishment phase. The table below shows the number of nests recorded, grouped by London Borough boundary, since the start of the outbreak monitoring exercise and indicates the steady overall climb in nest numbers.

OPM nest records by boroughs in 2007, 2008 and 2009 – table.

Borough	2007	2008	2009
Brent	76	18	15
Ealing	458	51	214
Hounslow	3	13	361
Richmond	171	424	1501
Total	708	506	2091

The above figures, though informative, are insufficiently broken down to site level to reveal certain features. The interim report figures for 2010 (below) reveal a success. A change in treatment methods, to include Deltamethrin as a prophylactic spray on previously heavily infested sites in the following (2010) season, had a remarkable effect in reducing nest numbers.

Comparison of OPM nests found on key sites in 2009 and 2010 (interim figures) – table.

Sites	2009	2010
Kew	600	10
Nearby Private site	1000	4
Kew Riverside (Richmond Council)	70	10
New sites in area (interim figure provided)	20	1000

However, these figures for 2010 also show over 1000 new nests found. This is not in conformity with the success noted above, since they refer to new nests on newly infested sites as the outbreak spreads geographically.

One of the most alarming instances of new infestation is Richmond Park which has a large Oak population over a large area and (as a SSSI) presents implications for accepted treatment methods, discussed in Part 2 and the Appendices.

In 2010 the geographical area of the infested zone is approximately 150 km. sq. (Greater London approximately 1600 km.sq.) The area has increased each year since 2006 and will continue to grow unless greater action and priority is given to the treatment and eradication of the pest.

1.4. Organisation of the response to date

Over the last three years the outbreak has been managed through an Outbreak Management Team (OMT) chaired by the Forestry Commission who have appointed a team of Plant Health inspectors - surveying entomologists - who identify the presence of the pest and serve enforcement notices on landowners.

The OMT has done sterling work on the issue with limited resources and power. The legislation covering the issue does not allow the FC to provide compensation for commercial loss (timber, etc,) – i.e. cannot assist tree owners in dealing with the pest – and cannot carry out or pay for treatment itself.

Affected Local Authorities and other organisations managing trees and with responsibility to the public have been treating infestations since discovery of the pest. While some landowners have responded in

exemplary fashion, others have prevaricated to the extent that spraying treatment or nest removal have been delayed past the point at which they can be effective.

All the concerned agencies have learned with regard to the efficacy of various treatment measures but there is still concern over which methods are appropriate in certain areas – nest removal unaccompanied with spray treatments being the most questionable action in terms of effectiveness.

The LTOA regards the publicised recommendations not to plant Oak trees – for instance at the Olympic sites - with scepticism. The continued planting of Oak would at worst increase our susceptible tree population by such a small percentage as to hardly be considered measureable. The key issue is to successfully prevent the import and use of infested trees in particular, not oaks *per se*.

1.5. LTOA involvement

The LTOA has a special role in that the general population and many private tree owners, rightly or wrongly, look to local Councils to deal with such issues and much of the work has fallen to tree managers to address and the organisation brings together the overwhelming majority of London boroughs and has associate members who manage many thousands more of London's trees.

Since its involvement the LTOA has:

- Provided free training to members regarding the identification and treatment of OPM.
- Publicised the consequences of failure to eradicate this pest.
- Written to MPs and Mayor of London to seek funding for treatments (for both private and Local Authority trees) as above, trying to raise awareness of the consequences of failure to deal conclusively with this issue while it remains containable.
- Assisted the FC in mapping the outbreak and monitoring its spread.
- Offered support to members and other affected landowners by joining the OMT and setting up its own working party trying to raise awareness and utilising the extensive experience of the Tree Officers of affected boroughs.

Key Recommendations

Part Two details the specifics of inspection and eradication treatments – what to do when. This summary brings together those recommendations argued and explained in the following pages as a quick and simple reference sheet for tree officers and other OPM managers. It should not be used as a substitute for the full document.

Management/Tactics

- A tactical plan for surveying and treatment of OPM must be in place, so that resources can be applied in targeted fashion.
- Non-discovery of OPM in a tree previously known to have it should not be taken as an all clear from OPM as over-wintering may occur. Trees that have been infested at any time should be monitored for at least 3 years following formation of the last nest.
- Tree Officers must be trained and/or OPM specialists/entomologists employed, to complete surveys within any affected or threatened Borough.
- In neighbouring areas or when monitoring for spread into new areas, target nest formation. Do not waste resources looking for feeding signs.
- All trees nearby/on neighbouring sites should be continually monitored from Mid-June to identify OPM nests.
- All contract staff and grounds maintenance staff should be trained regarding identification of nests as pupae and nests can be within two metres of the ground and staff and public may come into contact with them.
- Target inspections along transport routes leading from known areas of infestation.

Treatments

- Choose the right treatment at the right moment. This is critical. Use a combined-action treatment.
- Do not rely on physical removal or spraying in isolation. Use a combined-action treatment.
- Spraying treatments undertaken from June must be followed by physical collection of toxic material. This will include nest material and killed larvae on the ground around trees. Use a combined-action treatment.
- Carry out preparation works, such as ivy removal, on Oak near infestation sites. It will make surveying and treatment easier in the following season. If there are suspicions that a tree is already infested PPE issues may arise.
- Preventative spraying of previously affected trees will limit or stop OPM. This can be done with either BT or Deltamethrin as appropriate and is cost effective.

PART TWO - LTOA Recommendations

This document is not intended to replace any of the recommendations from the FC regarding approved treatment methods; it is to assist tree managers, informing them of the experience of colleagues. In the following text we have highlighted the key points and issues that we believe all those managing OPM need to consider. There are a number of recommendations included and details regarding the treatments and their advantages/disadvantages are covered in Appendix 1.

As LA Tree Managers we are often required to balance good arboricultural practice and tree health, with value for money and public health. Comparative costs are therefore indicated as well as information on effectiveness and possible environmental costs.

2.1. OPM Life Cycle

It should be noted that new information on the life cycle of OPM is still appearing. The Forestry Commission through Forest Research, update their publications on a regular basis. The timing of surveying and various treatment operations are determined by the life cycle of the pest. For instance, it has recently been suggested that pupae may overwinter. Such changes in life cycle could have major effects on treatment regimes. This document will be updated to report the latest science provided by the FC and Forest Research. The most up to date life cycle is included with the FC publication 'Survey and intervention in relation to different phases of the Oak Processionary Moth life cycle'.

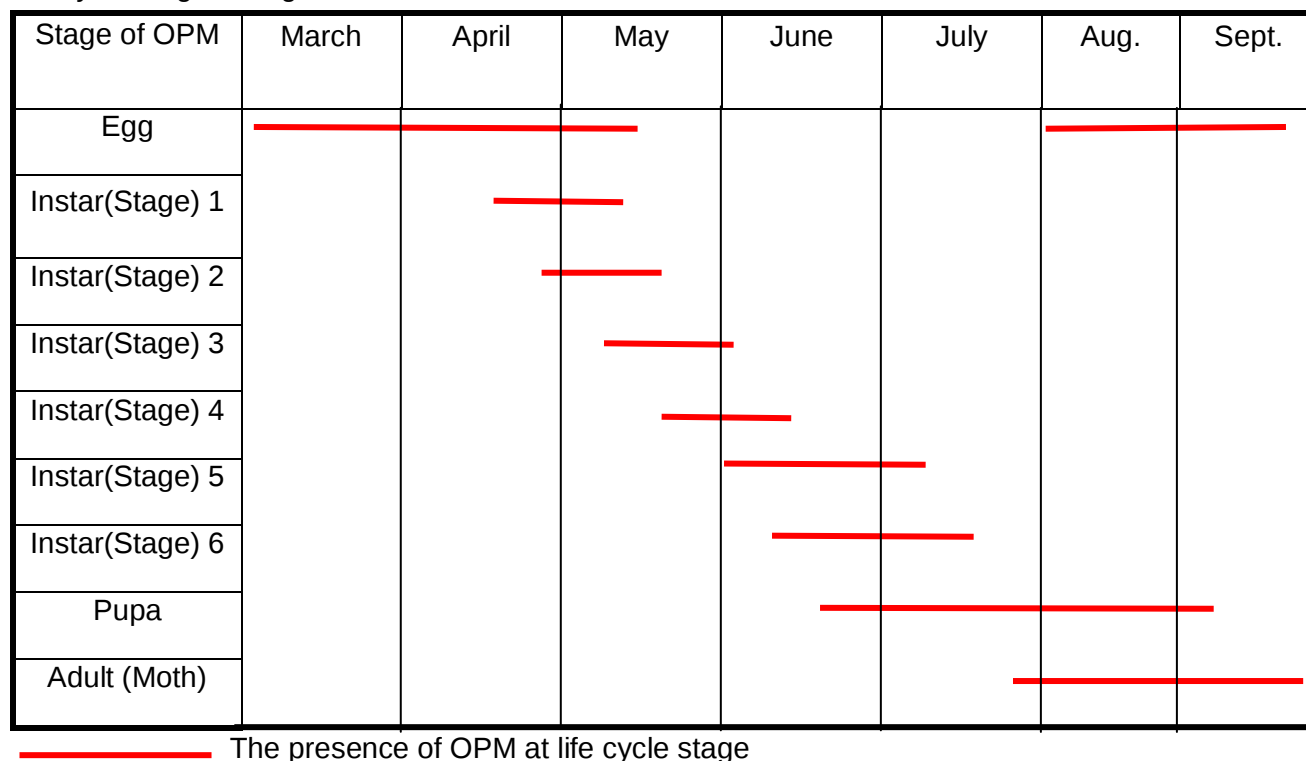
- Egg hatch just prior to leaf break of English Oak. Larvae will eat into and feed on buds at this point.
- Growth stages (instars) 3/4 are key as this is when the toxins are produced and temporary tent nests start to form, as larvae will feed over night and rest during the day. This can occur as early as late May.
- Stage 5 may change their resting place and usually move further down the tree from early June.
- Stage 6 create the final pupal nests. These are usually large and will be on main scaffold branches or trunk of a tree.
- From late July onwards adults emerge and fly.

Note that OPM females are often mated almost immediately after emergence and therefore will not travel large distances before laying eggs. These gravid females (weighted down with eggs) may avoid flying unless the tree cannot support the current population, at which time they will move the next available tree.

Due to these constraints it is general for laden females to, for instance, follow, but not cross, major transport links to increase their access to new territory. An absolute figure for the range of gravid females is impossible to judge, being dependent on factors such as wind speed and direction, etc,

Various figures have been given by different sources. The FC protection zone, proposed only, at the time of this publication gives a precautionary radius of 10 km. Most, but not all, other estimates are more conservative.

OPM life cycle stage – diagram



As well as the indicating factors for identification of OPM changing as the Caterpillar develops, the effective treatment methods change. Therefore the treatment methods used need to be determined from accurate inspections and be targeted to accurately identify OPM development stage appropriate to the treatment and matched to the available resources.

- **Recommendation** – A tactical plan for surveying and treatment of OPM must be in place, so that resources can be applied in targeted fashion.
- **Recommendation** - Non-discovery of OPM in a tree previously known to have it should not be taken as an all clear from OPM as over-wintering may occur. Trees that have been infested at any time should be monitored for at least 3 years following formation of the last nest.

2.2. Inspection

The identification of OPM depending on the time of the year can be simple or very difficult.

- **Recommendation** - Tree Officers must be trained and/or OPM specialists/entomologists employed, to complete surveys within any affected or threatened Borough.

The considerations of the surveying officers monitoring infested areas are:
October 2010

- **Mid April – early May – Caterpillar stage 1-3**

Early feeding signs are difficult to spot and therefore inspections are only worthwhile in areas where infestation was known in the previous season or if done by specialist inspectors. This early identification can be useful to target trees for spraying treatment or removal of young (non-toxic) caterpillars, but generally the time and skill required to spot feeding damage and confirm as OPM is excessive.

- **Early May – June - Caterpillar stage 4/5.**

Later feeding signs and nest formation are much simpler to identify as groups move further into the larger, main scaffolds of the tree and congregate in larger groups. They eat more and therefore feeding signs are more noticeable in the upper canopy. Individuals are also larger. As they shed their skins they may produce temporary tents which may go on to become the pupal nest. Nests are the easy way to spot OPM.

- **From Early June – Caterpillar stage 6 to pupation.**

Caterpillars construct what will usually become pupal nests. Larvae become more nocturnal and rarely seen in daylight but leave a trail of silk as they move into the canopy to feed, useful for finding OPM.

NB: From stage 3/ 4 the caterpillars and nests are toxic and therefore removal will need to include collection and disposal under careful control. A recommendation to this effect will be found under 'Treatment' (below).

Both of the survey periods have been utilised, with varying degrees of success depending on the inspector's skill and training.

The second, surveying for stage 4 onwards, is more effective when looking in trees surrounding those affected in previous years and when inspecting areas neighbouring current infestations. These should also be done in mid-May to late June.

The chances of spotting new outbreaks and colonies before this are limited and may lead to trees being given the all clear when infestation was just not noticeable. It is further recommended that all trees are re-inspected continually throughout the infestation period.

- **Recommendation** – In neighbouring areas or when monitoring for spread into new areas, target nest formation. Do not waste resources looking for feeding signs.
- **Recommendation** - All trees nearby/on neighbouring sites should be continually monitored from Mid-June to identify OPM nests.
- **Recommendation** - All contract staff and grounds maintenance staff should be trained regarding identification of nests as pupae and nests can be within two metres of the ground and staff and public may come into contact with them.

The final factor to consider when planning inspection is the distribution of gravid females referred to above in 2.2 The OPM life cycle. The laden females have a tendency to follow or be drawn along air currents such as those present near major transport links.

- **Recommendation** - Target inspections along transport routes leading from known areas of infestation.

2.3. Treatment

The FC Treatment Guidance document (2010 Forestry Commission) identifies a range of recommended methods of treatment. Difficulties described earlier and the variations in vulnerability of the pest make it difficult to treat effectively. Most of the recommended treatment methods have small windows of opportunity within the caterpillar's life where they are effective. Great care is required in determining treatment methods and timing.

- **Recommendation** – Choose the right treatment at the right moment. This is critical. Use a combined-action treatment.
- **Recommendation** – Do not rely on physical removal or spraying in isolation. Use a combined-action treatment.

Below is a summary of the advantages and disadvantages of the different treatment methods that have been employed in Ealing, Brent and Richmond. Further details and considerations of these treatments have been included as Appendix 1.

Treatment methods	Advantages	Disadvantages
Spraying	• Can be done before the Caterpillars develop the toxins (before stage 3/4). • Relatively labour light. • Limited exposure for operatives to pest risk. • Can cover large land areas as per tree coverage is quick. • Deltamethrin can be used as a single application spray*¹ and therefore cheapest. • BT limited environmental impact as Lepidoptera specific. • Prophylactic spraying is effective. • Can be used effectively to cover large trees.	• Limited chemical choice, see appendix 1 table for details. • Can be detrimental to environment (see chemical Pros-Cons table, appendix 1). • If spraying after stage 4 Toxic caterpillars and nests will also still require removal. • Application methods can require specialist equipment.
Physical Removal	• Single treatment method, to remove all toxic material • Very targeted to OPM. • Minimal environmental impact. • Very good on individual trees where single nests have been found late in the season or best done following a Deltamethrin application.	• Have to allow development of nests and therefore toxins will have developed. • Very labour intensive. • Increase exposure of operatives. • Colonies can be missed. • Material needs to be disposed of in line with WM2 Hazardous waste classification

*1 – 2010 figures show from Kew show a large reduction in nest formation following a single application.

This table shows that both methods have their place and will both be needed to effectively control OPM. A site specific assessment will be required to identify the best use of the methods and treatments available.

- **Recommendation** – Spraying treatments undertaken from June must be followed by physical collection of toxic material. This will include nest material and killed larvae on the ground around trees. Use a combined-action treatment.
- **Recommendation** - Carry out preparation works, such as ivy removal, on Oak near infestation sites. It will make surveying and treatment easier in the following season. If there are suspicions that a tree is already infested PPE issues may arise.

- **Recommendation** - Preventative spraying of previously affected trees will limit or stop OPM. This can be done with either BT or Deltamethrin as appropriate and is cost effective.

OPM Treatment Timeline – table.

	May	June	July	August
Spraying with BT				
Spraying with Deltamethrin				
Physical removal				

 Effective treatment period

2.4. Costs

LTOA member boroughs and others have been treating OPM for a number of years without extra external funding and therefore each council has had to find the resource to treat their OPM outbreak. The costs of treatment each year reflect the number of sites and the methods that have been used for treatment.

Comparison of costs from Local Authorities and Royal Parks for 2009 and 2010 - table.

All costs are estimated to the end of the season	Richmond Council		Ealing Council (including Brent)		Richmond Park
Year	2009	2010	2009	2010	2010
Surveying costs	£9,000	£10,500	£3,000	£8,000	£12,500
Spraying costs	£8,000	£11,500	£2,500	£11,500	Nil
Physical nest removal costs	£10,000	£15,000	£7,000	£5,000	£9,500
Total (excluding VAT)	£27,000	£37,000	£12,500	£24,500	£22,000

Deltamethrin is more cost effective than BT. The main increase in cost associated with BT is the increased number of applications needed for it to be effective, whereas Deltamethrin only requires a

single well timed application. From amongst the spraying costs above, the difference is clearly demonstrated by a case study undertaken in Richmond:

- In 2009 a BT trial was undertaken on 6 trees. The total cost for spraying was £8,000 due to the need for multiple applications. However, nests were still found in late June on all trees.
- In 2010, although £11,500 was spent on spraying, this was preventative treatment on many trees that contained nests in 2009. There was a single application of Deltamethrin following which only a small number of nests were found.

For Richmond Park, the efficacy or otherwise of treating without any chemical use at all will not be revealed until 2011.

General References

Forestry Commission, 2010, Survey and intervention in relation to different phases of the Oak Processionary moth life cycle.

Forestry Commission website, Oak Processionary Moth, accessed 2010

Townsend M, 2008, Report on survey and control of Oak Processionary Moth *Thaumetopoea processionea* (Linnaeus) (Lepidoptera: Thaumetopoeidae) (OPM) in London 2008.

Appendix 1 - Detailed feedback on treatment methods tried.

The information detailed in this appendix has been collected from the joint experiences of treatment methods that have been employed in affected Boroughs to date.

The Forestry Commission (FC) has developed and maintains an up to date OPM treatment matrix, included within the 'Survey and intervention in relation to different phases of the OPM life cycle, Forestry Commission'. This appendix is to be used in conjunction with that document which identifies both suitable spraying and physical removal techniques. See references.

A1.1. Spraying

A1.1.1. Spraying – Chemicals currently available for use

The FC identifies 3 different chemical active agents for use on amenity trees for the control of OPM. They are as follows:

Product Name	Active Agent	Comments
DiPel DF	Bacillus thuringiensis (BT)	Biological agent. Requires follow up spray after 7-10 days. Targeted towards moth caterpillar species.
Agriguard - deltamethrin Bandu Decis Decis Protech Pearl Micro	Deltamethrin	Fast acting, but broad spectrum pyrethroid insecticide.
Dimilin Flo	Difubenzuron	Growth regulator. Approved for amenity vegetation & hedges. Requires follow up spraying after 2 weeks.

(Survey and intervention in relation to different phases of the oak Processionary moth life cycle, Forestry Commission, May 2010)

A1.1.2. Spraying – Comparison of chemicals currently available for use.

The following table lists the advantages and disadvantages of the chemicals from the experience of the Tree Officer. This is NOT a chemical usage assessment and therefore carries no regulatory recommendations for use.

Active Agent	Advantages	Disadvantages
Bacillus thuringiensis (BT)	• Selective kill – Lepidoptera (moth caterpillars)	• Only effective on young larvae (stages 1-3). • A single application would not be considered effective, 2 or 3 applications would be required. • Short active half life. • Has to be ingested to affect larvae, therefore needs to be applied to extreme canopy tips to affect feeding sites.
Deltamethrin	• Will kill all ages of Larvae in a single application. • Is a contact insecticide, therefore if the larvae walk over it they will be killed. • Has a long half life (noted in the field 2-3 weeks). • Application can be restricted to scaffold rather than canopy, if targeting larger larvae.	• Non-selective kill, will affect all insects. • Can't be used near water courses (including storm water gullies).
Difubenzuron	• Selective kill – Lepidoptera (moth caterpillars)	• Is a growth regulator, rather than killing chemical. • Only effective on young larvae (stages 1-3). • A single application would not be considered effective, 2 or 3 applications would be required. • Short active half-life. • Has to be ingested to affect larvae, therefore needs to be applied to extreme canopy tips to affect feeding sites.

There has been extensive usage by LTOA members of both BT and Deltamethrin. The results have been mixed, resulting in the information displayed in the table.

A1.1.3. Spraying - application

The following explanation is summarised in the table at the foot of this section.

Chemicals can be applied to the entire canopy or, if spraying Deltamethrin, targeting of the main structural branches only.

The behavioural pattern of the pest demands these variations in application methods. Their effectiveness is determined by the age of the larvae to be treated.

When the larvae are very young they will stay in the outer canopy feeding and grouping on buds. At this stage no chemical spray will be fully effective.

After leaf break and the Caterpillars reach stage 2, then canopy drenching or outer canopy spray is needed. This application method has been used for both Deltamethrin and BT. Before application a full pesticide risk assessment will be needed, as complete canopy drench is likely to have a bigger environmental impact than other spraying. This method of application can be used with all the chemicals listed above.

The targeted spraying of structural branches can only be used against older larvae, from stage 4 when they begin to develop tents and travel greater distances around the tree. It is also only effective for use with Deltamethrin as this is a contact insecticide. Both the other recommended chemicals require ingestion. Targeted spraying will limit the environmental impact of the use of Deltamethrin as the volumes and contact areas are reduced and away from other canopy feeding insects. Only insects that walk on the inner structure will be affected, rather than everything in the canopy. As the target areas are so much smaller than the full canopy, they may need to be effectively covered for a long period of time. Therefore multiple applications may be necessary to span the time when the pest is mobile in the canopy. Economy/effectiveness therefore requires careful timing.

Public exclusion is obviously necessary during spraying operations and consideration should be given to exclusion during periods when dead larvae may be falling from treated trees.

Application Method	Advantages	Disadvantages
Canopy drench	• Complete tree cover of foliage, therefore effective against young larvae. • Can be used for all chemicals. • Can be done from the ground with correct equipment. • If used with Deltamethrin at the correct time only a single application is needed. • It will kill Larvae before they become toxic, therefore no tidying needed.	• Large amount of chemical needed. • If used with Deltamethrin contact pesticide, will have large environmental impact on all invertebrates in canopy. • Specialist equipment
Targeted Scaffold spray	• Will not affect canopy insects that don't travel on structure, making it more specific to OPM. • Lesser environmental impact as application method makes it more selective. • Single application likely, with less chemical than canopy drench. • Can wait to apply to trees were infection is proven, nesting and feeding signs noted.	• Only possible with Deltamethrin, as contact insecticide. • Travelling larvae will be older than stage 3/4 and therefore toxic, so will need to be collected following death. • Dead larvae may drop from tree. • MEWP required by the operator for application. • Need for OPM PPE for operations within the canopy of affected trees.

A1.2. Physical removal

Personal Protective Equipment details are given in Appendix 4.

Physical removal of OPM is possible due to the nesting habitat of the pest. Throughout larval development they will congregate. From stage 4/5 they begin to develop tents in the branching structure. These are small web structures where the larvae can shelter and skin shed, at this stage the groups are small and the structures are temporary and sometimes moving. As the larvae develop into stages 5 and 6 these groups become bigger and the tents become more permanent nests.

Vacuum techniques are the safest and most efficient methods of physical removal at this stage.

These larger larvae groups will feed in the upper canopy overnight and then group in the nest during the day. At this point the removal of the nests will take all larvae with them. Both the larvae and the nests are toxic and therefore must be removed using controlled methods.

The removal of nests requires climber access or MEWP access to the tree. It can be done using simple nest bagging or removal with a specialised vacuum. All material removed needs to be disposed of in accordance with WM2 hazardous waste classification.

Application Method	Advantages	Disadvantages
Fixing – using sprays, resins, etc, Bagging (from branches). Burning – blowlamps, etc,	• Minimum specialist equipment needed. • Low cost other than labour and PPE.	• Exposes of climber and groundsman to OPM. • Very labour intensive, this can be helped with use of MEWP. • Burning of remaining hairs can damage cambium. • Climbing kit can't be LOLER tested and therefore must be binned yearly. • Need for OPM PPE as operations within the canopy of affected trees.
Vacuum.	• Vacuum requires no direct contact with nests. • Can be used to collect larvae groups on stems, branches or even ground. • Quicker and less effort for climber as MEWP sighted with 5m reach. • Smaller vacuum can be used within canopy.	• Climbing kit can't be LOLER tested and therefore must be binned yearly. • Exposure of climber and groundsman to OPM. • Need for OPM PPE as operations with the canopy of affected trees.

APPENDIX 2 - OPM - Waste disposal

The toxic hairs which are produced by OPM from stage 3 onwards can create health problems if not safely disposed of or if handled incorrectly. Correct handling is required when collecting caterpillar bodies (after stage 3) or nest material. PPE and disposal in line with hazard waste regulations is required.

All waste produced during OPM operations should be placed and stored in sealed containers to avoid releases of hairs into the local environment. If carrying out physical nest removal, nests should be bagged.

If using a vacuum, they should be removed in the vacuum bag and stored in a sealed container before removal off-site.

A2.1. Classification

OPM material is considered as a hazardous waste material under the regulations as it can be directly linked to one or more of three of the points on the Environmental Agencies (EA) 'List of Wastes – Hazardous Properties'. The following points apply directly to OPM:

- H4 "Irritant": non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucus membrane, can cause inflammation.
- H5 "Harmful": substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks.
- H14 "Ecotoxic": substances and preparations which present or may present immediate or delayed risks for one or more sectors of the environment.

At the time of publications these regulations only applied to England and Wales.

Waste can be classified under the List of Wastes Regulations 2005 also known as the European Waste Catalogue, depending on the type of waste. This is divided into Chapter and sub-chapters giving a 6 figure waste reference number. Material relating to OPM will be classified by the following Chapter and sub-chapter as:

- Chapter 02 - Wastes from Agriculture, Horticulture, Aquaculture, Forestry, Hunting and Fishing, Food Preparation and Processing
 - 02 01 02 - animal-tissue waste.

If waste is incinerated on site then the matter is resolved, if it is to be moved then the carrier must hold a waste carriers license.

The EA [website](#) publishes guidance and management procedures required to dispose of hazardous waste, plus the resources necessary to complete the required procedures.

A2.2. Registering premises

In accordance with the regulations registration is required if;

- the premises produces or stores 500kg or more of hazardous waste in a year
- if hazardous waste is moved to a site for storage or disposal, if volumes exceed 500kg.

Where the quantity of hazardous waste is lower than 500kg, the site is automatically classed as exempt and does not require registration or notification to the EA.

According to the EA, waste that is '*...produced during construction, repair or maintenance by one or more mobile services...*' means that '*... you may not need to notify your premises (EA, 2008)*'. The definitions of mobile service are detailed in the EA guidance HWR07 Mobile Services. Depending on the situation it is advised to consult the regulations to determine the need to register. As the waste is the product of the removal of OPM and this is facilitated by a mobile contractor, it would be reasonable to assume that this process could be counted as repair or maintenance.

The EA states that it is the responsibility of the premises owner to decide whether or not premises should be registered. The amount of waste produced in any one removal operation or site is likely to be less than 500kg, unless the site is very large or has very heavy infestation e.g. large parklands, recreational facilities.

A2.3. Moving the waste

As OPM waste is classified as hazardous, whether being moved to a registered facility or to a exempt site, there is a requirement to complete a consignment note. '*With very few exceptions, a consignment note must be completed to accompany hazardous waste when it is moved from any premises. This includes premises that are exempt from registration (EA, 2008)*'.

A hazardous waste consignment note is required even if the holder of the waste does not change, unlike a duty-of-care transfer note.' (EA, Sept 2010).

A2.4. Keeping records of hazardous waste

If you remove, transport and/or dispose of hazardous waste materials then you are required to by the EA to keep records of this. Notes regarding this and a guide to the record keeping are available from their website <http://www.environment-agency.gov.uk/business/topics/waste/32192.aspx>

A2.5. Further information regarding hazardous waste

The EA website can provide updated recommendations regarding the management of hazardous waste. There is an extensive 'frequently asked questions' section which may provide further information, or contact them directly on:

FAQ - www.environment-agency.gov.uk

Environment Agency - General enquiries

Telephone: 08708 506 506 (Mon-Fri, 8am - 6pm)

Email: enquiries@environment-agency.gov.uk (do not use for reporting environmental incidents)

Postal address: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY

Waste registration

Hazardous waste registration: 08708 502 858* (Mon-Fri, 9am - 5pm)

A2.6. Specific References

Environment Agency, HWR Version 4 – July 2008, What is Hazardous Waste, A guide to the Hazardous Waste Regulations and the List of Waste Regulations in England and Wales

Environment Agency website, accessed Sept 2010, Moving Hazardous Waste, <http://www.environment-agency.gov.uk/business/topics/waste/32196.aspx>

APPENDIX 3 - Medical symptoms associated with OPM

As has been suggested throughout this Guidance Note the toxic hairs released from OPM have adverse effects on people and animals. This appendix summarises the current position regarding the health aspects.

Any one that has come into contact with the hairs directly or indirectly and develops symptoms is advised to contact their GP. This guidance is not a medical document and therefore is not written to advise regarding treatment or diagnosis of symptoms.

The Health Protection Agency (HPA) have been involved in the management of OPM through the OMT group since its discovery in 2006. They have played a supporting role to the lead of the FC and to date have not taken any active role in the management or control of OPM. They have issued a number of press releases to advise health professionals of the presence of OPM in west London and the identification symptoms. There is also a brief FAQ section on their website on OPM.

A3.1. Human health problems

The adult moths are harmless. The larvae however are covered in hairs. From the 3rd instar (stage 3 – late May to July) they also develop tens of thousands of microscopic hairs, among the larger hairs. These hairs are only 0.1 to 0.2mm in length, and contain the toxic protein thaumetopoein that causes the release of histamines, which can result in an allergic reaction in humans (Townsend, 2008).

Exposure to these the tiny sharp toxic hairs will often cause irritation and allergic skin reactions in both people and animals. Contact most commonly causes intensely itchy or painful skin rashes and can also result in sore throats and irritated eyes.

People vary in their response - not everyone reacts to the caterpillar hairs. The most common problem is an itchy rash which is unpleasant but not dangerous (HPA, 2010, A).

However, the reactions in humans and animals can be severe and include dermatitis, conjunctivitis and pulmonary effects.

In cases of high exposure to OPM there have been recorded instances of anaphylactic shock in humans (Townsend, 2008), which, of course, can be very serious.

The symptoms are known collectively as lepidopterism.

A3.2. How you can be affected

Direct contact with the caterpillars is not necessary, because the hairs are so small and are disturbed during moult between stages/instars or during movement and nest access. They are thus often airborne. Due to the size of these hairs they can be carried for considerable distances from affected trees. Swiss forest scientists believe that hairs can be carried for up to 200m (Burri, Schniepper, 2009), which is

considerably further than the distances quoted by the HPA. With this in mind it is possible that affected people will not have encountered the caterpillars or their nests directly or be aware of the cause of their problems.

Direct contact with the nest or caterpillars can result in pronounced reactions and should be followed by seeking medical advice.

Rashes commonly occur on exposed parts of the body. Staff involved in inspection are advised to cover exposed skin and if working in these areas to wear correct PPE. Effects can be worsened by prolonged or repeated exposure.

There will almost certainly be a need to exclude members of the public from areas of heavy infestation.

A3.3. Treatments

Symptoms can be treated with antihistamines or skin treatments available from local pharmacies. Anyone who experiences a severe allergic reaction or who is uncertain what has caused their rash should consult their GP. (HPA 2010) In a recent presentation the HPA advised that dermatological corticosteroids (eg Triamcinolone acetonide 0.01%) is the most common treatment used and that Antihistamine drugs are not normally necessary (Polain, Walsh, 2010).

Measures that should be taken immediately following exposure:

- Shower immediately, wash hair (rinse with soap, do not rub), change clothes.
- Do not scratch; free possible contaminated areas of skin using adhesive tape.
- The affected areas can be treated with antihistamine (E.g. Fenistil).
- Should there be extreme itching or if other conspicuous symptoms should appear a doctor should be consulted and she/he should be informed that the person has been in contact with caterpillar hairs.

(Burri, Schniepper, 2009)

It is recommended that any persons exposed see a GP for professional medical advice.

A3.4. Specific References

Health Protection Agency, 2010, A, Oak processionary moth: frequently asked questions,
<http://www.hpa.org.uk/Topics/ChemicalsAndPoisons/CompendiumOfChemicalHazards/OakProcessionaryMoths/GeneralInformation/>

Health Protection Agency, 2010, B, Health alert for west London due to the oak processionary moth, <http://www.hpa.org.uk/ProductsServices/LocalServices/London/LondonPressReleases/lond100512OakProcessionaryMoth/>

Polain O, Walsh B, 2010, The human health impacts of the Oak processionary moth – Presentation, [http://www.forestry.gov.uk/pdf/olivierlepolainpresent23mar2010.pdf/\\$FILE/olivierlepolainpresent23mar2010.pdf](http://www.forestry.gov.uk/pdf/olivierlepolainpresent23mar2010.pdf/$FILE/olivierlepolainpresent23mar2010.pdf)

Townsend M, 2008, Report on survey and control of Oak Processionary Moth *Thaumetopoea processionea* (Linnaeus) (Lepidoptera: Thaumetopoeidae) (OPM) in London 2008.

Monika Burri, Maja Schniepper (Gruner AG), Beware of caterpillars with urticating hairs, 2006 http://www.waldwissen.net/themen/waldschutz/insekten/wsl_schmetterlingsraupen_brennhaare_EN, accessed 2010

APPENDIX 4 – Decontamination

Following contact with OPM, hairs are likely to be trapped on clothing and equipment. It is therefore essential that correct decontamination processes are put in place for operatives undertaking OPM related work.

A4.1. Clothing

The HPA are happy to support the approach that a wash at 60C will break down the protein in the toxin and render it harmless. This however will not affect the hair, which they suggest may pose a further threat and therefore it may be prudent to run the washing machine on an empty cycle afterwards.

- Contaminated clothes should be stored in an air tight container and washed separately at 60 °C, or even hotter. (Burri, Schniepper, 2009)

Information regarding the washing of exposed skin is included within Appendix 3

A4.2. Equipment

A4.2.1. Climbing kits

It is recommended that normal (everyday) climbing kit is not used in the treatment of OPM. It is highly possible that rope, harnesses, etc. will come in to contact with the hairs. Therefore, it is recommended that dedicated OPM treatment kits are created to enable nest removal operations.

Following operations, kits should be stowed in sealed containers whilst on site and prior to operatives removing PPE. These containers should not be opened before operatives have PPE on, as hairs will be released as the kit is moved.

In line with LOLER regulations kit will need to be tested. A judgement will have to be made by the LOLER inspector how they undertake the inspection and, of course, the inspector must be made aware that the kit has been in use for OPM works. Care should be taken when feeling the rope as hairs will be throughout the length and therefore protective gloves must be worn, though these may affect the inspector's feel on the rope.

A4.2.1. PPE

Paper suits (practical protection coverall EN1073-2) and gloves (EN388 or 374) should be removed on site and stowed in sealed containers for disposal with other waste.

Breathing filter unit (EN143, 397, 166 compliant, with P3-dust filter) should be stowed away from other OPM PPE equipment, so not to increase the contact with OPM hairs. Due the material of construction, in most cases PVC or plastic, the chances of hairs remaining are low, However they should not be handled without PPE. Filters should be replaced yearly and old filters disposed of in line with other OPM waste.

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A4.3. Specific References

Monika Burri, Maja Schniepper (Gruner AG), Beware of caterpillars with urticating hairs, 2006
http://www.waldwissen.net/themen/waldschutz/insekten/wsl_schmetterlingsraupen_brennhaare_EN,
accessed 2010

Appendix 5 – Legislation

A5.1. The Plant Health (Forestry) Order 2005

The Plant Health (Forestry) Order 2005 No. 2517 Part 6 - - MEASURES TO CONTROL THE LANDING OF RELEVANT MATERIAL AND PREVENT THE SPREAD OF TREE PESTS.

In the order as quoted above the, Sections 30-37 empower an authorised person to carry out inspection of premises and records for the purpose of enforcing the provisions of the order. It provides powers to serve notice on relevant parties for the destruction and control of an aforementioned pest and also gives powers to take custody of materials.

Powers are also given for the authorised inspector to undertake direct control of the pest on site. Further to this it allows the inspector to instruct and determine how and where material is transported and destroyed.

Within the order there is a requirement for the served party to inform the inspector when they have fully complied with the order so it can be re-inspected and discharged.

A5.2. Specific References

The Plant Health (Forestry) Order 2005 No. 2517 Part 6 - MEASURES TO CONTROL THE LANDING OF RELEVANT MATERIAL AND PREVENT THE SPREAD OF TREE PESTS,
<http://www.legislation.gov.uk/ukSI/2005/2517/part/6/made>, accessed Sept 2010.

Appendix 6. Species susceptibility.

The two sections of *Quercus* preferred as a food plant by OPM are QUERCUS and CERRIS. These sections include most of the European oaks (OPM is, after all an 'Old World' species).

This includes those sometimes referred to as the 'White oaks' – examples of those relevant to us - *Q. robur*, *Q. petraea*, cvs of these and incidentally, the american *Q. alba*.

The CERRIS section includes *Q. cerris*, *Q. castaneifolia* and hybrids such as *Q x turneri*.

Those commonly referred to as Red Oaks, *Q. rubra*, *Q. coccinea*, *Q. palustris*, etc, and commonly planted, are less susceptible. In RBG Kew these oaks have not been affected, but one should remember that there were plenty of alternative meals on the menu there and indeed the pest has been found in 2010 on *Q. rubra* and *Q. imbricaria*.

In some areas on the European mainland where oaks are absent *Carpinus betulus* has been a host. It is therefore possible even if much less likely, that outside of heavy concentrations of native oak, the Red oaks could host the pest more frequently.

The densely foliated fastigate forms of *Q. robur* are certainly a favourite.

A6.1. Species to inspect

In a very broadly descending order of susceptibility the following species have been identified as hosts for OPM:

Q. cerris

Q. robur

Q. robur 'Fastigiata'

Q. robur 'Koster'

Q. castaneifolia and cvs.

Q. alba

Q. x turneri

Q. hispanica 'Lucombeana'

Q. ilex

Q. canariensis

Q. frainetto

Q. petraea (comparative rare in the outbreak zone)

Q. suber

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