OPM to be targeted by aerial spraying

How aerial spraying in the South of the UK is bidding to halt the march of Oak Processionary Moth, writes Terry Mabbett

MAIN ABOVE: Aerial spraying using a Robinson 244 helicopter fitted with Micronair AU700 atomisers (Picture Micron Sprayers Ltd)

FAR LEFT: The adult oak processionary moth lays its eggs in plaques (strips) on small branches in the upper reaches of the oak tree canopy (Picture Forestry Commission)

SECOND LEFT: Operators need to monitor the timing of egg hatch in spring. A plaque of OPM (Picture Forestry Commission)

LEFT: Older and larger larvae with their higher body mass require larger doses of insecticide to cause mortality (Picture Forestry Commission)

about the author

Dr Terry Mabbett

Dr Terry Mabbett is a disease, pest and weed control specialist with forty years international experience covering research, advisory and journalism. His current fields of focus are professional turf and alien insect pests and pathogens of Britain's native and naturalised trees.

The message on the grapevine is that oak processionary moth (OPM) could at last be controlled by aerial spraying in the UK. After five years of dithering, the UK Plant Health Authorities appear to be learning a lesson, taking the lead from their counterparts in Germany and trialling aerial application of insecticide against OPM.

OPM (Thaumetopoea processionea) is moving mainly westwards and southwards from its initial twin infestation focus on oak trees imported from the Netherlands and planted in the London Boroughs of Richmond and Ealing during 2005/2006. A total of nine contiguous London Boroughs – Richmond, Ealing, Hounslow, Brent, Hammersmith and Fulham, Kensington and Chelsea, Kingston, Merton and Wandsworth are now affected by this main infestation. Last summer the infestation leapfrogged the Thames from its southern front at Hampton Court and into the Elmbridge area of North Surrey.

Two ongoing 'satellite' infestations, originating from later separate introductions of OPM on oak trees also imported from the Netherlands, are in the Pangbourne area of West Berkshire and the West Wickham area of the London Borough of Bromley. This latest infestation has spilled over into the neighbouring London Borough of Croydon.

Aerial spraying is not something done on the hoof with pilots leaping into cockpits wearing ten-gallon hats and shouting 'chocs away'. It requires thorough planning and regulatory hoops to be jumped through, especially since nearly all OPM affected oak trees in the UK are in urban and suburban areas.

Any aerial spraying undertaken will be carried out using helicopters to apply the biological insecticide Bacillus thuringiensis subsp. kurstaki (BT). Aerial spraying experts will carefully consider and calculate a comprehensive range of spray and formulation factors and parameters. These will include aircraft speed, height above the target, nature and concentration of the liquid formulation used, mean droplet diameter and droplet size distribution, spray volume and insecticide dose sprayed per unit area, as well as wind speed and wind direction on the day.

Biological perspectives

In addition, there will be key biological factors and requirements, related to OPM larva behaviour and the canopy characteristics of oak trees, that must be understood and satisfied if the programme is going to work, irrespective of how nominally accurate aerial application might be.

Spray timing is crucially important for several reasons. BT kills OPM larvae via ingestion and stomach action through larvae feeding on the foliage. Consequently the target for spray droplets is the new oak leaves produced in spring, usually appearing from mid-April onwards with OPM larvae hatching sometime during the second half of April.

The twin synchronised starting points are therefore timing of oak tree re-foliation and hatching of the L1 (first instar) larvae from plaques of insect eggs on small branches at the top of the canopy. Both are dependent on temperature. An early spring with higher than normal temperature should realistically see earlier synchronised oak tree re-foliation and larval hatch, and vice versa.

Next thing to be established is when the larvae start to feed on bursting buds, young leaves and flowers. Is it immediately after hatching or sometime thereafter? If a contact insecticide is used spray operators would additionally benefit from knowing when larvae are most exposed to spray droplets by being, for instance, on the upper (adaxial) surface of oak leaves.

Synchronisation of aerial application with start of larval feeding is vital for another very important reason. Youngest small larvae (L1, L2 and early stage L3) are the easiest to kill with insecticide. The lower the larval body mass then a correspondingly lower dose of active insecticide ingredient is required to kill the larva.

Secondly this is the only time during the entire juvenile insect stage period that larvae will be permanently feeding on foliage in the outer shell of foliage at the top of the oak tree canopy where the bulk of spray droplets from aerial application will be deposited. Once larvae have successfully passed through the L3 (third instar) stage they are that much bigger and heavier with correspondingly higher doses of insecticide required to achieve mortality.

OPM larvae in the late L3 to L6 stages spend progressively more time during the day on the trunk and main scaffold branches and increasingly in their silken nests. As such they are less likely to be feeding in on the outer canopy shell at the tops of trees where BT depos-

its are made, so they will become increasing difficult to 'reach' by aerial spraying.

Larvae start to develop the irritating hairs from L3 onwards, and last thing wanted is for thousands of dead larvae with still active stinging hairs falling out of oak trees after aerial application of insecticide.

The window of aerial spray application opportunity is clearly quite narrow and generally closed by mid-May.

Collection of biological data is standard practice when planning any spray programme against a lepidopterous (butterfly and moth) larval (caterpillar) insect pest, but is easier said than done on a 20m tall oak tree than a 1m high cotton plant.

Nevertheless it needs to be done and clearly requires entomologists in MEWPs (cherry pickers) to see exactly what is going in the tops of oak trees infested with OPM.

Longevity of BT on plant foliage is relatively short.

The product is applied as a water-dispersible granule and is therefore prone to wash off from the foliage by rainfall. Activity is also reduced by UV light levels which can clearly be high at the tops of tall oak trees.

These factors, depending on spring weather experienced, may shorten the interval before a follow-up spray application is needed.

Aerial spraying trials on trees are ideally carried out on larger expanses of woodland and as such the majority of golf courses might not seem like the obvious place to start. However, word on the grapevine is that trials may involve (by necessity) spraying by helicopter of small groups of oak trees or even individual trees.

Provided it is carried out when play is not in progress, golf courses would appear to offer as good a place and opportunity as anywhere, within an urban or suburban area, to trial aerial application of insecticide against OPM.

A number of golf courses are already being forced to use ground spraying equipment against OPM every year with many more at risk. BT is completely harmless to humans. It has been used for many years as a bioinsecticide in agriculture and horticulture to control lepidopterous larvae on dozens of different everyday fruit and vegetable crops.

Collateral cost: aerial spraying against OPM

One question sure to be asked by today's environmentally-aware greenkeeper is the extent of any collateral ecological damage from aerial application. Provided aerial spraying against OPM is well planned, well timed and carried out with the required precision any ecological fall-out should be minimal, and acceptable given the alternative of giving OPM a 'clear run' and 'free hand'.

BT is specifically active against the larval stages of the Lepidoptera (butterflies and moths) and only via ingestion and stomach action. OPM larvae have to eat BT covered oak foliage to pick up a potentially lethal dose.

No other class of insect or arthropod (e.g. woodlice) is affected. Only insects at potential risk are Lepidoptera which use oak as a larval food plant and only one native British butterfly falls into this category. Larvae of the purple hairstreak (Neozephyrus quercus) feed on pedunculate oak (Quercus robur) and sessile oak (Q. petraea) and sometimes Turkey oak (Q.

cerris) and evergreen or holm oak (Q. ilex).

Whether the purple hair streak is at risk from sprays of BT will largely depend on timing of egg hatch and larval feeding and how this matches with that of OPM. However, 'oddities' in larval feeding behaviour indicate purple hairstreak could avoid significant collateral damage.

The female purple hairstreak lays eggs singly at bases of plump oak buds in late summer. It prefers mature trees outside of dense woodland, and often isolated hedgerow and landscape oaks with twisted and gnarled branches, just the sort of oak trees found on many golf courses.

Eggs hatch is synchronised with first signs of bud break. However, L1 (first instar) larvae do not start to feed from the outside but burrow into buds and stay there feeding safely until the first moult is complete. As larvae get larger and oak buds open, they spin silken protective retreats outside and feed only at night. During growth and development of the larva there are three moults prior to pupation.

These idiosyncrasies may be enough to spare the purple hairstreak from most risk and damage. Egg hatch and appearance of L1 larvae starts well before that of OPM with some British butterfly websites indicating the first half of March, which means up to 8 weeks before any OPM spraying can be contemplated.

Situation for moths is more complicated in number at least. No less than 2400 different moth species have been recorded in Britain including 800 found regularly. In Northumberland over 50 different species of moth are recorded with either Q. robur or Q. petraea as a larval food plant.

However, the larval stage of many moth species is in June and July well after any anticipated spraying against OPM.

Last but not least is 'His Majesty', the male purple emperor butterfly (Apatura iris). Purple emperor butterflies are closely associated with oak woodland although the female lays its eggs on sallow, mainly great sallow (Salix caprea) and also called goat willow or pussy willow, growing at the woodland margin and along woodland rides.

With sallow as the larval food plant the purple emperor should be safe. However, the adult butterflies drink oak sap and honeydew excretions from aphids feeding on oak foliage.

Whether or not they could pick up BT in this way, and indeed whether BT would be infective against the adult insect stage, is something which doesn't appear to have been considered.

ABOVE RIGHT: Late L3 to L6 larvae spend more daytime hours on the trunk and main scaffold branches and increasingly in their silken nests (Picture Forestry Commission)