

THE FIRST OCCURRENCE OF LARVAE OF THE BOX TREE MOTH, *CYDALIMA PERSPECTALIS* (LEPIDOPTERA: CRAMBIDAE) IN PRIVATE GARDENS IN THE UK

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ABSTRACT

The box tree moth *Cydalima perspectalis* (Walker) is a native of East Asia that has recently become established in mainland Europe. The caterpillars of the moth defoliate box (*Buxus*) plants. Adult moths have been recorded in parts of England since 2008 and larvae have been reported at one commercial nursery in 2008 and 2009. In 2011 caterpillars of the moth were found in private gardens in South East England for the first time. Available reports of the moth are presented and its potential effect on ornamental and native *Buxus* plants discussed.

INTRODUCTION

The box tree moth *Cydalima perspectalis* (Walker) (Plate 1, Fig. 1) feeds primarily on box (*Buxus* spp., Buxaceae) and is native to East Asia (China, Republic of Korea and Japan) (Mally & Nuss, 2010). In mainland Europe *C. perspectalis* was first reported from Germany in 2007, although it may have been present since 2005 (EPPO, 2008; Krüger, 2008; van der Straten & Muus, 2009). *Cydalima perspectalis* has since become widespread in northern Germany (EPPO, 2010a). It reached Switzerland in 2007 where it has spread rapidly (Leuthardt, Billen, & Baur, 2010), the Netherlands and France in 2008 (van der Straten & Muus, 2009; EPPO, 2010a), and Austria in 2009 (EPPO, 2010b).

In the UK an adult *C. perspectalis* was first recorded (in a light trap) in September 2008 from Weybridge, Surrey (Mitchell, 2009) and adults had been reported on ten occasions from southern England by the end of 2010 (Fish & Reeves, 2010, M. Parsons pers. comm., 2011). Larvae have been recorded on two occasions, September 2008 and 2009, in the UK at a plant nursery in Surrey (unpublished Food and Environment Research Agency (Fera) data). In May 2011 the Royal Horticultural Society (RHS) received the first report of caterpillars in a UK private garden at Stoke Poges, Bucks; two further records of the caterpillars were received by the RHS in 2011. These records are presented below and the current status of *C. perspectalis* in the UK is discussed, along with its biology and the damage it is likely to cause to its host plants in the UK.

DISTRIBUTION AND CONFIRMED BREEDING IN THE UK

Subsequent to the first record *C. perspectalis* occurred on two further occasions in September 2008 in East Sussex (Mitchell, *loc.cit.*). Adults were also recorded in 2009 and 2010 from South Essex, East Kent, Buckinghamshire, South Gloucestershire and Hertfordshire (Table 1, Fig. 1). Prior to 2011 larvae had been detected at a commercial nursery in Surrey on two occasions (ix/2008 and ix/2009; Fera data). In May 2011 the RHS received a verbal description of *C. perspectalis* caterpillars feeding on *Buxus* sp. from Stoke Poges, Bucks., the first record of larvae in a private garden in the UK. The Plant Health and Seeds Inspectorate (PHSI) collected and

Table 1. Records of the box tree moth, *Cydalima perspectalis* from the UK.

Location	10 km	Date(s)	Notes
Weybridge, Surrey ¹	TQ05	04/ix/2008	Adult, to light
Icklesham, E. Sussex ²	TQ81	23 & 24/ix/2008	Adults, to light
Leigh-on-Sea, Essex ³	TQ88	18/ix/2009	Adult, to light
Biddenden, Kent ^{4,5}	TQ83	21/ix/2009	Adult, to light
Densole, Kent ⁴	TR24	13/vii/2010	Adult, to light
Stoke Poges, Bucks. ^{4,6}	SU98	11 & 26/vii/2010	Adults, to light
Bishop's Stortford, Herts. ²	TL45	08/viii/2010	Adult, to light
Bristol, S. Glos. ^{4,6}	ST67	08/x/2010	Adult, to light
Woodford Green, S. Essex ⁷	TQ49	22 & 24/vi/2011	Adults
Commercial nursery, Surrey ⁶		ix/2008	1 larva, 3 pupae (1 empty)
Commercial nursery, Surrey ⁶		ix/2009	3 larvae, 8 pupae
Stoke Poges, Bucks. ⁸	SU98	17/v/2011	45 larvae, two pupae
Nr Harlow, Herts. ⁸	TL41	25/v/2011	Two larvae
Buckhurst Hill, S. Essex ⁸	TQ49	23/viii/2011	Two larvae

Sources: 1, Mitchell, 2009; 2, Fish & Reeves, 2010; 3, Tunmore & Hill, 2009; 4, M. Parsons *pers. comm.*; 5, S. Broyd, see postscript to Bailey, 2010; 6, Fera; 7, R. Barfoot *pers. comm.*; 8, RHS.

sent 45 larvae and two pupae to the Fera laboratory where the identity was confirmed. Caterpillars of *C. perspectalis* were reported to the Royal Horticultural Society on two additional occasions in 2011; two caterpillars were brought to the RHS Chelsea Flower Show, from Gilstone Park, Hertfordshire (25/v/2011) and two caterpillars from a garden in Buckhurst Hill, South Essex (23/viii/2011). On both occasions, these were likely to have been samples from larger infestations. A report of adult moths was also received from Woodford Green, South Essex on 23 and 24 June 2011 (R. Barfoot, *pers. comm.*).

SYNONYMY & IDENTIFICATION

The currently accepted name for the box tree moth is *Cydalima perspectalis* (Walker, 1859) (Mally & Nuss, 2010), although it has been placed in a number of genera since its arrival in Europe, including *Glyphodes*, *Neoglyphodes*, *Palpita* and, most commonly in the UK, *Diaphania* (Korycinska & Eyre, 2011).

The following description of the different life stages and damage is taken from Korycinska & Eyre (2011). The typical form of the adult (Plate 1, Fig. 1) has a wingspan of approximately 40 mm, the wings have a thick, faintly iridescent, golden dark brown border of uneven width around the edges of both pairs of white-coloured wings, the white parts being tinged with purple. The head is dark brown, thorax white anteriorly brown, abdomen largely white but its posterior end dark brown. A less common colour variant has completely brown wings, except for a small white streak on the forewing about half way along the front edge.

The eggs are laid in a flat sheet, overlapping each other, on the underside of box leaves. When first laid, they are pale yellow, but as they mature, the eggs develop a black spot where the larval head capsule is forming.

Newly hatched larvae are coloured greenish yellow, with black heads. As the larva develops the head remains black and the green body develops dark brown stripes. Mature larvae reach a length of up to 40 mm and retain a yellowish green ground colour, but develop a pattern of thick black and thin white stripes along the length of the body, with large black dots outlined in white on the dorsal surface (Plate 1, Fig. 2).

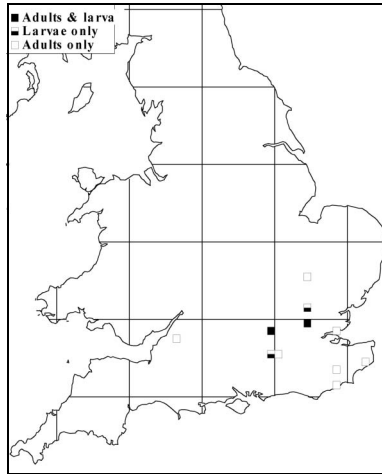


Fig. 1. Records of the box tree moth, *Cydalima perspectalis* (Walker) in England, September 2008 to October 2011. © RHS, Fera, M. Parsons (*pers. comm.*) and published data. Produced using Dmap©.

First instar larvae feed by ‘windowing’, eating the lower surface of leaves only and leaving the upper epidermis intact. Older larvae feed inside silk webbing and skeletonise the leaves of host plants, leaving only the midribs, and occasionally the outer margin, intact. Webbing, frass and moulted black head capsules may also be apparent.

The clearest evidence of *C. perspectalis* is the damage it causes to *Buxus* plants, which become disfigured by the loss of leaves and the presence of webbing spun by the larvae; this is especially apparent on trimmed plants (e.g., hedges and topiary).

The pupae are concealed in cocoons of white webbing spun among the foliage on the host plant. The pupae are between 15 and 20 mm long; they are initially green with dark stripes on the dorsal surface but older pupae turn brown.

A joint press release issued by the RHS and Fera in July 2011 (RHS, 2011), alerting the media to the presence of *C. perspectalis* resulted in several articles in national newspapers and garden magazines. Twenty-one suspected cases of *C. perspectalis* were reported to the RHS, though all but two of these enquiries related to various yellow and black caterpillars feeding on plants other than *Buxus*, ruling out *C. perspectalis*. Those enquiries where the caterpillars were identifiable, included within the Lepidoptera, large white (*Pieris brassicae* (L.), Pieridae, four enquiries), mullein moth (*Shargacucullia verbasci* (L.), Noctuidae, three enquiries), toadflax brocade (*Calophasia lunula* (Hufnagel), Noctuidae, two enquiries), buff tip (*Phalera bucephala* (L.), Notodontidae, two enquiries), lackey moth (*Malacosoma neustria* (L.), Lasiocampidae, one enquiry) and within the Hymenoptera, berberis sawfly (*Arge berberidis* Schrank, Argidae, one enquiry).

LIFECYCLE AND HOSTS

In Europe, *C. perspectalis* larvae have so far been observed feeding on five taxa of box (the species *Buxus microphylla* Siebold Zuccarini, *B. sempervirens* L. and *B. sinica*

Rehder & Wilson, and the cultivars *B. sinica* var. *insularis* and *B. sempervirens* ‘Rotundifolia’) (Leuthardt, Billen, & Baur, 2010). There is some evidence of differences in susceptibility of hosts, with the cultivar *B. sempervirens* ‘Rotundifolia’ possibly less susceptible than *B. sempervirens* (Leuthardt, Billen, & Baur, 2010). Experimentally, *B. microphylla* provided the best larval growth rate at a range of temperatures (Maruyama, 1993). In Asia other reported hosts include purple-leaved holly (*Ilex purpurea* Hassk, Aquifoliaceae), Japanese spindle (*Euonymus japonicus*, Thunberg, Celastraceae), and burning bush (*Euonymus alatus* (Thunberg)), (Korycinska & Eyre, 2011). However, unpublished tests by the Plant Protection Service of the Netherlands have produced negative results with these hosts (van der Straten & Muus, 2009).

The biology of *C. perspectalis* in Europe has not been studied in detail. In south west Germany and Switzerland, there are probably two or three generations between May and September (Leuthardt, Billen, & Baur, 2010). In China three to five generations a year have been noted (Tang, Qin, & Sun, 1990), and Japanese populations in the Tokyo area have three generations a year (Maruyama & Shinkaji, 1987). Studies in Japan indicate that there are typically six larval instars and that larval development takes approximately 23 days at 25°C (Maruyama & Shinkaji, 1991). *Cydalima perspectalis* overwinters as first, second or third instar larvae, which shelter between two leaves bound together with silk in autumn, and they complete their development the following spring (Maruyama & Shinkaji, 1991). One of the caterpillars received by the RHS on 25/05/2011 pupated on 29/05/2011, emerging as an adult after 18 days at room temperature (24°C ± 5°C, and a natural daylight cycle). The presence of larvae in the UK in both late spring and late summer 2011 indicate that it is possible that two generations of *C. perspectalis* occurred in 2011.

Adults of both sexes of *C. perspectalis* are capable of flight but its natural dispersal capabilities are not thoroughly known (Korycinska & Eyre, 2011). In Germany it has been found to be spreading at 5–10 km a year (van der Straten & Muus, 2009).

DISCUSSION

It is clear that *C. perspectalis* is becoming established in the UK. It is thought that the pathway of introduction of *C. perspectalis* into Europe was trade in commodities from East Asia, possibly as a stowaway with granite stones (Leuthardt, Billen, & Baur, 2010; Korycinska & Eyre, 2011). Eggs, diapausing larvae and pupae are all associated with *Buxus* foliage and are difficult to detect, hence trade in box plants may explain some of the moth’s dispersal in Europe. Infested plants have been found on sale in garden centres around Basel (Leuthardt, Billen, & Baur, 2010) and plant trade is a possible mode of entry into the UK (Korycinska & Eyre, 2011). It is also possible that the moth entered the UK naturally through migration from continental Europe; the proximity to the southern coast of England of some records may indicate that this was the mode of entry for at least some adult moths. Due to the likelihood of natural introduction from Europe no further statutory action against this insect is being taken by Fera (Korycinska & Eyre, 2011).

The presence of *C. perspectalis* in the UK is likely to have an effect on ornamental plantings in gardens and parks. The defoliation and dieback are unsightly, and reduce the amenity value of the plants. However, also of concern is potential damage to the uncommon native box plants (*B. sempervirens*) found in parts of southern England, notably on Box Hill, Surrey. *Cydalima perspectalis* has caused serious damage to native *B. sempervirens* plants in Switzerland (M. Kenis *pers. comm.*, 2011).

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PLATE 1. Fig. 1. Box tree moth *Cydalima perspectalis* (Walker) adult © RHS. Fig. 2. Box tree Moth *Cydalima perspectalis* (Walker) larva © RHS.