Pests and diseases

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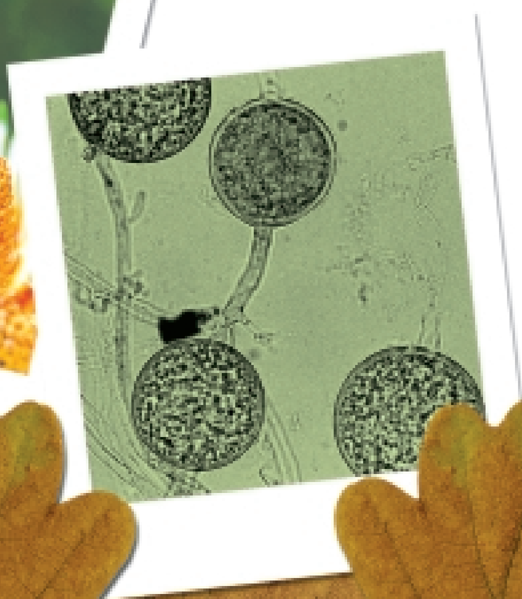
The association between pests and diseases and their host trees is a dynamic and evolving process driven by a number of ecological, climatic and anthropogenic factors (Evans, 2001). Britain as an island has a flora and fauna that is relatively impoverished compared with mainland Europe but nevertheless has a wide diversity of plants and animals, most of which are of value from both biodiversity and social perspectives.

Red band needle blight in Corsican pine

Adult female pine looper moth, a periodic pest of various pine species in Britain
(photo: Robert Thompson)

Chlamydospores of Phytophthora ramorum, the pathogen causing the disease known as Sudden Oak Death in the USA



Introduction

Our island status does provides a degree of protection from the natural ingress of damaging organisms that could pose threats to our woodlands if they became established here. For example, the eight-toothed spruce bark beetle, *Ips typographus*, periodically reaches epidemic population levels in the spruce forests of Northern Europe. Despite numerous interceptions associated with imported wood, the beetle has not established in Britain and measures, including debarking or heat treatment of wood, are in place to reduce the risk of successful establishment. It is also interesting to note that the same beetle is on the prohibited lists of a number of countries including Australia, Canada, New Zealand, South Africa and the USA. This reflects the fact that numbers of new interceptions and establishments continue to rise in Great Britain and internationally and that concerted action is needed to reduce the rate of movement of damaging organisms in wood during international trade.

Despite the implementation of quarantine procedures under EU and National legislation, successful establishment of invasive damaging species does take place. In Great Britain this is evidenced by the appearance of *Phytophthora ramorum*, the cause of sudden oak death in the USA (Webber and Evans, 2002) and horse chestnut leaf miner, *Cameraria ohridella* (Evans and Webber, 2001; and the current report, page 33) in the past two years alone. Vigilance is vital in early detection of new incursions, particularly if there is to be any prospect of eradication of a pioneer population before it has become widely distributed. The strong international contacts established by staff in the Entomology and Pathology Branches have allowed them to recognise threats as they develop elsewhere and to provide early warning of potentially damaging organisms. Both *P. ramorum* and *C. ohridella* were flagged up as potential threats and publicised using Exotic Pest Alerts (EPAs) in paper and electronic forms, thus aiding the early detection of the two organisms soon after their arrival in Britain.

Technology transfer through written, electronic and, particularly, verbal presentations is, therefore, becoming increasingly important in making practitioners and members of the public aware of threats from invasive species. The value of well-illustrated articles and leaflets on pest and disease threats is clear and are increasingly being combined with electronic forms of publication. In addition to the two recent Exotic Pest Alerts already mentioned, a series of posters and an EPA for Asian longhorn beetle, *Anoplophora glabripennis*, have been produced and are available for download on the Forestry Commission Plant Health Service Website (http://www.forestry.gov.uk/forestry/hcou-4u4j4j). Other publications to aid identification of problems include books on Christmas tree pests (Carter and Winter, 1998), diseases and disorders of forest trees (Gregory and Redfern, 1998), tree hazards (Lonsdale, 1999) and diagnosis of ill-health in trees (Strouts and Winter, 2000) as well as a wide selection of scientific and popular articles on these subjects.

Increasingly, the importance of direct contact with practitioners is being recognised and staff from Entomology and Pathology are regular contributors to Forest Health Days and to meetings and seminars on the subject of plant health. During 2002, staff gave presentations and practical workshops at 12 locations, five in Scotland, two in Wales and five in England. Attendees came from a wide range of organisations and interests including Forest Enterprise, Forestry Commission, local authorities, the National Trust, English Nature and the Environment Agency. These presentations provided a valuable opportunity both to impart the latest information and also to interact directly with those who are most likely to spot pioneer infestations of new or, indeed, native pest organisms. Increasing awareness and expanding the number of individuals who have this awareness is one of the key elements in our continuing efforts to retain and enhance the health of woodlands. Further efforts to improve delivery of these aims will continue.

Figure 1a

Adult female *Lymantria dispar.*

(photo: Ronald S. Kelley, Vermont Dept of Forests, Parks and Recreation)

Figure 1b

A cluster of *Lymantria dispar* females laying eggs within hairy egg masses.

(photo: William M. Ciesla, Forest Health management International.)

Threats from abroad

Gypsy moth

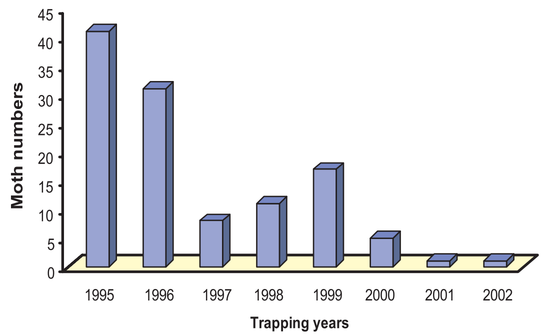
The small outbreak of the Gypsy moth, *Lymantria dispar* (L.), shown in Figure 1a and b, discovered in June 1995 in the South Woodford area of northeast London has persisted in the area despite eradication attempts. Although severe defoliation by the caterpillars is predicted as unlikely under current UK climate conditions, there is a potential threat of sporadic severe defoliation of important amenity trees in Epping Forest. Monitoring by use of pheromone traps again in 2002 has confirmed that the population is declining but has not been eliminated (Figure 2).

The marked decline in numbers in recent years indicates that the colony, which is the first breeding group in the UK since 1907, may be on the verge of extinction. Continued monitoring will show whether this is the case or just a phase of a natural population cycle.

In June 2002 Gypsy moth caterpillars were found feeding on young chestnut trees in the central south coast area of Jersey. Between 60 and 70 trees were found to be affected and a spraying operation was carried out in an attempt to eliminate these caterpillars. However, 200 pheromone traps set out during the adult flight period caught in excess of 500 adult male moths in just 3 weeks, indicating the possibility of a well-established population on the island. There have been regular catches of small numbers of male moths in the past, assumed to be migrants from the continent, but no signs of a breeding population on the island until now. For more information contact hugh.evans@forestry.gsi.gov.uk

Figure 2

Numbers of adult male gypsy moths caught in pheromone traps.



Horse chestnut leaf miner

The first finding in the UK of the horse chestnut leaf miner, *Cameraria ohridella*, was confirmed in July 2002 from a garden in the London Borough of Wimbledon (Figure 3). This moth was unknown in Europe before 1985 when it was found in Macedonia. Since then it has spread rapidly across Europe due mainly, it is thought, to the passive transportation of infested leaves on vehicles. Horse chestnut trees on the edge of Wimbledon common were found to be infested with *C. ohridella* but even higher populations of the moth were found in street trees in the centre of Wimbledon.

As its common name suggests, the larvae feed between the upper and lower surfaces of the leaves forming serpentine mines which, on heavily infested leaves, often merge together. This leads to browning and drying of the leaves and premature leaf fall that can affect 70–100% of the leaves on a single tree. Horse chestnut, *Aesculus hippocastanum,* is the main host but Norway maple, *Acer platanoides,* and sycamore, *A. pseudoplatanus,* are also reported to be susceptible. All three species are significant amenity trees planted in urban and suburban areas.

C. ohridella has several overlapping generations during the summer so numbers can build up rapidly; both the primary and secondary flush of leaves are affected. Three generations seems to be the average in Western Europe but up to five generations have been reported in hotter drier conditions. Trees heavily attacked by *C. ohridella* are reported not to die but the damage may prove, over time, to lead to an overall gradual decline in tree vigour. This is not the case with other species of leaf miners associated with UK trees, which have only a single generation in a year and therefore a limited damage period, and are merely regarded as disfiguring.

Apart from the removal and burning of infested leaves in autumn there is no other practicable form of control recommended at present. More information about this pest can be obtained from christine.tilbury@forestry.gsi.gov.uk

Figure 3

Early infestation by horse chestnut leaf miner on a tree in Wimbledon.

Phytophthora ramorum: cause of sudden oak death in the USA

This new pathogen has now been isolated at more than 200 nurseries in the UK, where it has been found infecting rhododendron and viburnum. Surveys have not detected *Phytophthora ramorum* on any trees but current research is assessing the potential susceptibility of a wide range of tree species. Tests on oak and other key woodland and forestry species have been carried out under a Ministry of Agriculture Licence in high security quarantine containment chambers at CABI, Silwood Park. The objective is to assess the risk posed by *P. ramorum* to UK/European tree species. In all, the following 23 hosts have been tested:

Quercus robur	*Prunus lauroseracus*
Alnus glutinosa	*Castanea sativa*
Quercus ilex	*Pseudotsuga menziesii*
Tilia cordata	*Picea sitchensis*
Quercus cerris	*Carpinus betulus*
Populus tremula	*Taxus baccata*
Quercus suber	*Betula pendula*
Ulmus procera	*Acer platanoides*
Quercus rubra	*Sequoia sempervirens*
Fraxinus excelsior	*Rhododendron ponticum*
Fagus sylvatica	*Aesculus hippocastaneum*
	Chamaecyparis lawsoniana

On the basis of these results, the various tree hosts have been categorised into more susceptible species, e.g. *Q. rubra* and *F. sylvatica*, less susceptible species, e.g. *Q. robur* and *A. hippocastanum,* and resistant, *e.g. T. cordata* (Figure 4). Some conifer species such as Douglas-fir and Sitka spruce have also proved to be highly susceptible in these tests, although all the tests involve wounding the bark so it does not indicate the effectiveness of the pathogen when infecting unwounded bark. The experiments have also indicated that there can be significant differences between the resistance levels of individual trees of the same species.

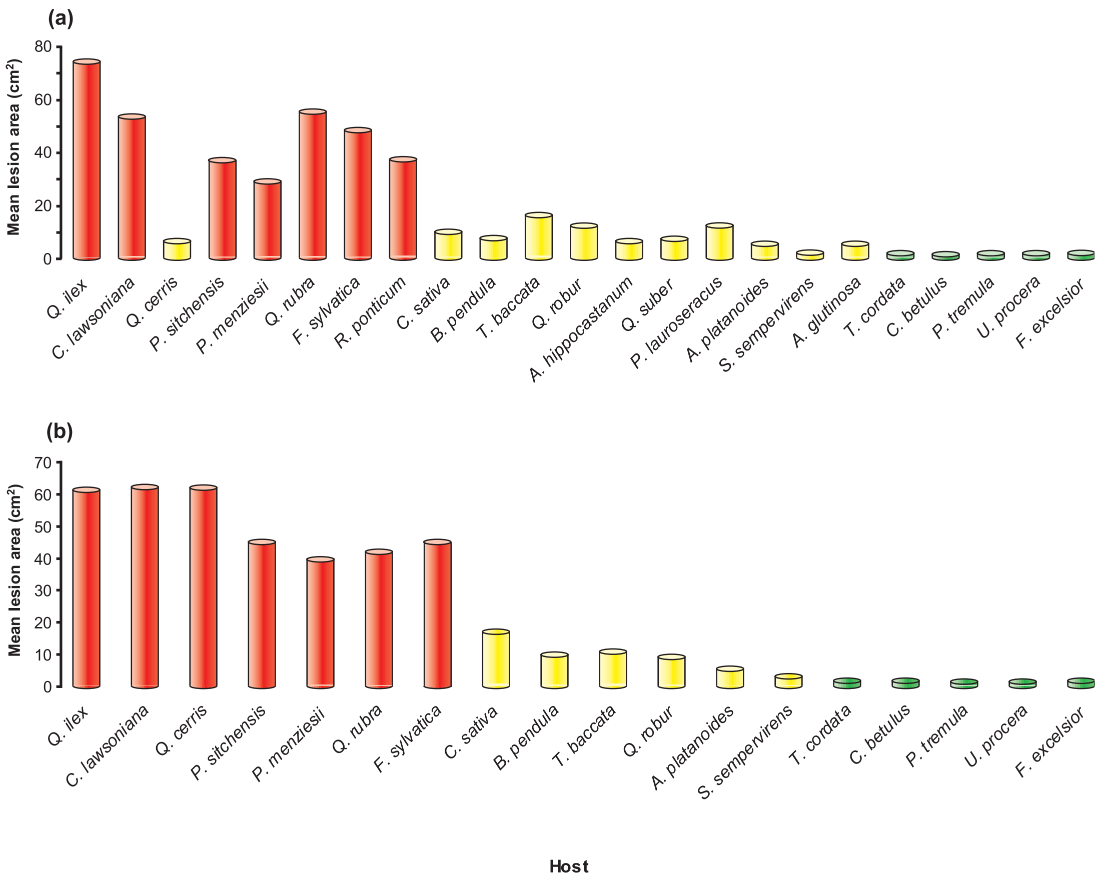
Tests also revealed that the USA populations of *P. ramorum* were much more variable than the European populations of the pathogen (Figure 4a and b). The latter were morphologically uniform, fast growing, highly pathogenic and of a single mating type (A1). American isolates showed a range of pathogenic behaviour and growth rates, a variable morphology and all consisted of the A2 mating type. However, when the A1 and A2 isolates were paired together, normal mating rarely if ever occurred, indicating that *P. ramorum* may not have a normally functioning breeding system, possibly as a result of genetic divergence in the two populations.

Recently, German workers have reported that they have isolated a single isolate of the A2 mating type in Europe but it is not clear whether this fits the profile of the American population or is capable of mating with A1 isolates from Europe.

For more information about this disease, contact joan.webber@forestry.gsi.gov.uk or look at www.forestry.gov.uk/pramorum

Figure 4

Susceptibility of a range of tree species to *P. ramorum* originating from (a) Europe and (b) North America. Red colours indicate more susceptible hosts, yellow columns less susceptible hosts and green resistant or tolerant.



Established pests and diseases

Pine looper moth, *Bupalus piniaria*: annual survey

The annual pupal surveys for pine looper moth, *Bupalus piniaria*, have continued in those forest districts with concerns about the potential impact of this damaging moth. As indicated in Webber and Evans (2003), increasing damage is being reported on lodgepole pine in the far north of Scotland and therefore the national pupal surveys remain relevant to the health of the affected forests.

Numbers of pupae recorded in most areas this year (Table 1) fell well within the limits considered normal for a resident population, ranging from less than 1 to between 4 and 5 pupae per square metre (m^{-2}). In the two areas where this was exceeded, shown in bold, numbers were still well below the level at which any further action would be advised (25 pupae m^{-2}).

Table 1

Pine looper moth: numbers of pupae recorded in annual surveys 1997–2002.

Forest District	Unit	1997	1998	1999	2000	2001	2002
North York Moors	Revised transects						
	Area 1[a]	3.6	1.2	1.2	2.0	n/s	2.4
	Area 2[b]	0.0	0.8	0.4	0.4	n/s	0.8
	Area 3[c]	1.2	1.2	2.0	4.0	n/s	2.0
	Area 4[d]	2.8	2.0	1.6	0.4	n/s	**6.8**
Midlands	Cannock	6.0	0.8	0.4	0.4	n/s	n/s
	Swynnerton	2.0	0.0	0.4	0.4	n/s	n/s
Sherwood	Sherwood III	0.8	4.0	0.0	0.4	0.4	0.4
	Sherwood IV	1.6	1.2	0.4	0.4	0.4	0.8
Inverness	Culloden	0.4	3.6	0.8	1.6	1.6	1.2
Moray	Culbin	6.0	2.0	3.6	13.6	7.2	2.4
	Lossie	0.4	1.6	6.8	18.0	14.8	**7.6**
	Roseisle	4.4	1.2	2.8	4.8	2.4	1.6
	Speymouth	30.0	20.4	4.0	2.0	2.8	2.4
Tay	Montreathmont	23.2	1.2	2.4	6.4	1.2	2.4
	Ladybank/Edensmuir	0.0	0.0	0.4	1.2	2.8	0.4
	Tentsmuir/Reres	32.8	2.8	1.2	4.4	4.0	2.0
	Reres	n/s	n/s	n/s	2.2	4.8	2.0
Scottish Lowlands	Devilla	n/s	n/s	n/s	3.2	1.6	0.4

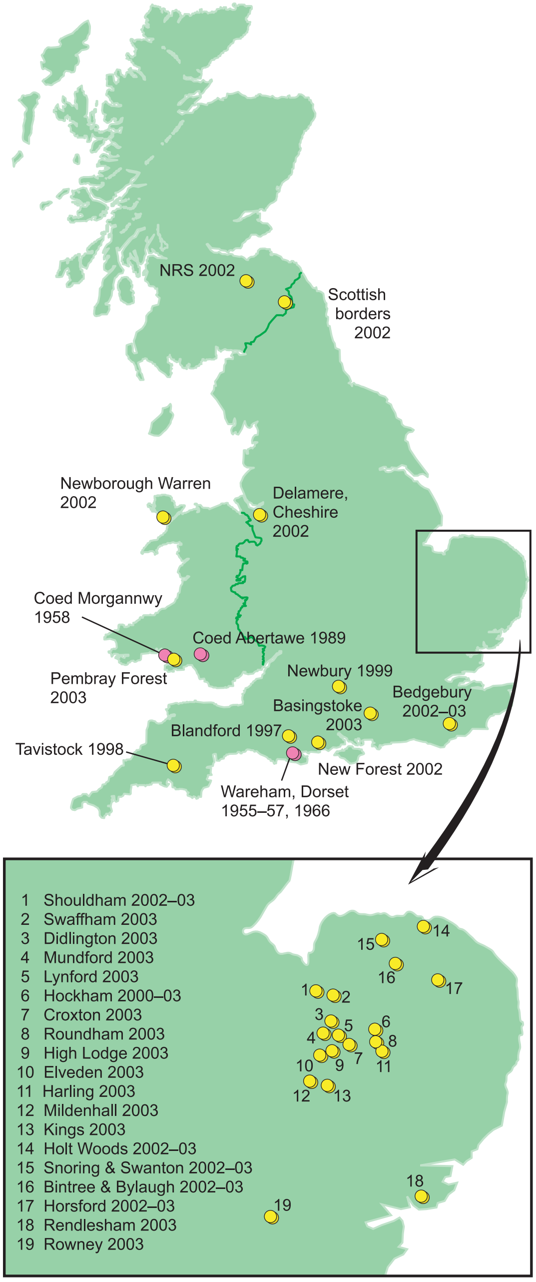
n/s: not surveyed.
[a]Area 1: Boltby/East Moor; Wass/Pry Rigg
[b]Area 2: Cropton; Dalby
[c]Area 3: Hardwood Dale/Broxa
[d]Area 4: Sneaton; Langdale/High Langdale

Shoot and needle diseases of pine

Several shoot and needle diseases of pine have been noticeable over the past year. Probably the most conspicuous example is red band needle blight, which has apparently been increasing in frequency for the past 4–5 years. The causal agent is the fungus *Dothistroma pini*, an introduced pathogen first seen in the UK in nursery stock in 1954 (see Brown *et al.,* 2003).

Figure 5

Accumulated records of *Dothistroma pini* in 2002.
Yellow = current survey.



Scots pine is relatively resistant to the disease but Corsican pine, *Pinus nigra* var. *laricicola*, is highly susceptible, so the main area affected by this disease has been in the East Anglia Forest District where Corsican pine is planted widely. The current distribution of the disease is shown in Figure 5 and it has recently been recorded in Scotland for the first time in two different locations. Within the East Anglia Forest District, it is now estimated that out of the total planted area of 15 000 ha of Corsican pine, trees over a 4000 ha area are suffering serious defoliation and some may have to be felled prematurely.

In addition to red band needle blight, there have been reports of scattered one-year-old shoots of two-needle pines (notably Corsican pine but also Scots pine) being killed by the fungus *Sphaeropsis sapinea*. The pathogen can be very damaging particularly if the host has already suffered shoot damage (hail and wind damage are frequently cited). This is recognised as a serious disease abroad, but in the UK the damage is usually slight and control is not considered necessary. However, during 2002 visible signs of shoot killing by *Sphaeropsis* have been common, particularly in Southern Britain, although there have not been enough records to estimate how widespread a problem this has become. The amount of damage cause by *Sphaeropsis* in areas such as Thetford Forest may also be masked by the damage already caused by red band needle blight.

Shoot and needle diseases have also become a feature of several New Native Woodland Grant Schemes in Scotland and this is causing concern because of the adverse affect on sustainability. In particular, *Lophodermium seditosum* has been frequently involved in outbreaks of needle browning and dieback on the Scots pine in young plantings. Three NNW schemes have suffered especially widespread damage from this pathogen with approximately 115 ha affected out of a total area of 200 ha.

Green spruce aphid, *Elatobium abietinum*

Reports of high numbers of the green spruce aphid, *Elatobium abietinum*, particularly on *Picea abies* and *P. sitchensis* were received from early spring onwards. Individual needles were yellow or showing yellow spots or bands where aphids had been feeding. By late spring, damage had become very obvious as yellowing needles became more abundant and many needles attacked earlier had turned brown and were completely dead (Figure 6). Trees looked at their worst in early summer, the damaged needles were falling and only the new growth at the tips of shoots remained relatively unaffected. Many were reported to resemble dead trees with soft new green growth at the ends of bare twigs. However, retention of the current year's growth usually allows trees to survive and recover but it will be several years before new shoots mask the damage as the defoliated parts of branches will not grow new needles. There are no insecticides approved for the control of the green spruce aphid in forest plantations and, although defoliation has been shown to cause a loss of increment, it is doubtful if chemical control could be justified in the forest on economic grounds.
For more information contact
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Figure 6

Damage to *Picea sitchensis* by *Elatobium abietinum*.

Alder disease and dieback in Scotland

Following the discovery in 1993 of a lethal disease of alder caused by a new species of *Phytophthora* which has now become widespread in England and Wales (Gibbs *et al.,* 2003) the disease has also been recorded at several locations in Scotland in recent years (Hendry, 2002). However, apart from *Phytophthora* disease, a serious dieback of native riparian alders has been observed in Scotland as long ago as the beginning of the last century. In contrast to alders affected with *Phytophthora* disease, trees with alder dieback do not show any evidence of tissue death at the root collar or in the structural and fine roots. Instead bark lesions occur on branches and commonly coalesce in the parent stem, resulting in girdling and branch and stem death. Underlying these lesions the wood is typically stained a dark brown and, on isolation, often yields the Ascomycete fungus *Valsa oxystoma*.

In 1999 a project was established to determine the severity of the problem via 11 permanent monitoring plots across mainland Scotland. In addition, the occurrence of *Phytophthora* disease was also assessed. *Phytophthora* disease appears to be largely confined to river catchments in the east of Scotland, with the disease recorded on the Avon, Tweed, Dee, Deveron, Duirinish and Spey. In contrast, the incidence of alder dieback tends to be confined to catchments in the north and west of Scotland. As the majority of western and northern Scottish rivers can be described as 'spate' systems which drain into small catchments, and in which water flow and water levels are inherently volatile, riparian alders in these areas, may be subjected to higher levels of environmental stress. These stresses, plus local site factors, are likely to contribute to the raised incidence of dieback, although there may be potential to manage affected stands of alder by encouraging regrowth via coppicing.
For more information about this research contact
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Oak pinhole borer, *Platypus cylindrus*

An increased number of reports of damage to felled timber and sawlogs in the south of Britain due to the oak pinhole borer, *Platypus cylindrus*, were received (Figure 7a and b). This insect is one of the few ambrosia beetles found in Britain; so-called because the larvae feed on specific ambrosia fungi that grow in the walls of tunnels bored into 'green wood' by the adult beetles. The presence of these fungi causes a blackening of the tunnels that is a characteristic of ambrosia beetle attack and helps to differentiate the damage from that caused by bark beetles.

The beetles can bore deep into the heartwood, making holes of about 1.6 mm in diameter, forming a branched gallery system that can reach a length of up to 1.8 m. They do not normally penetrate into the heartwood until the second year of their two-year life cycle. Infestation by ambrosia beetles will cease only when the wood has become too dry to support the growth of the fungi, i.e. between 30 and 40% moisture.

Logs can remain susceptible to attack by *P. cylindrus* for up to four years but are only at risk during the flight period of the adult beetle, from June to end of September. Prior to the hurricane of 1987 *P. cylindrus* was regarded as a rarity (British Red Data Books, 2 Insects: NCC, 1987). But by 1991, as a result of an abundance of breeding material, its numbers had increased dramatically in parts of Southern Britain. Numbers remained high for several years before falling back to a persistent but lower level. In spite of its common name, *oak pinhole borer* also attacks the timber of several other hardwoods. After oak they are most commonly found in sweet chestnut and beech and are also known to breed in ash, elm and walnut.

Figure 7

Damage by oak pinhole borer: (a) piles of fibrous frass marking entry points; (b) multiple attack of sweet chestnut log.

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