| | Potential threats in EU | Organism(s) | Means of spread | Control measures | Control approaches being used in other countries | Detection/ diagnostics | Scale of damage commercial loss amenity, landscape (die back, reduced vigour, tree mortality) | Knowledge gaps | Research in progress | Opportunities to work with others? Who? | Impact of research on control | Likelihood of developing practical control options | Longer term options |
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| | | | | *keep out, knowledge of trade routes, awareness on nurseries, foresters, general public* | | | | | | | | | |
| 11 | 8-toothed Europe spruce bark beetle | *Ips typographus* (beetle) | **Long-distance/ International:** International spread: Unbarked spruce logs/spruce bark from regions where native or established. **Locally:** infested logs, timber. Natural spread by adult flight | **Current:** import controls; destruction of infected wood/lumber; port inspections/ pheromone traps to intercept beetles. Eradication attempt essential if local incursion. | Risk assessment in mature spruce forests Monitoring with pheromone traps. Mass trapping has been used in large outbreaks Prompt removal of trees following windblow and forest hygiene. Felling & removal of infested trees before beetle emergence & destruction of infested bark. Pheromone mass trapping to detect any beetle populations. | Pheromone traps at docks where spruce imported. Signs of infestation include resin bleeding on stem. Discolouration of foliage. Galleries in bark | Occasional landscape scale outbreaks & tree mortality in overmature stands following windblow and/or pronged drought/high temperatures causing 'stress' on trees. Tree mortality along newly exposed forest edges. | Life cycle on Sitka spruce in UK, especially ability of moribund host material to support endemic populations. Susceptibility/resistance of mature Sitka & Norway spruce. Pathogenicity of beetle associated fungi to Sitka spruce. Potential fungal associates that could already be present in GB | EU protected zone surveys conducted annually. Assessment of invasibility of native UK bark beetle community to exotic bark beetles. | Potential for studies on Sitka spruce in continental Europe. | HIGH - Control methods and their applicability are research driven. | HIGH | Following introduction, risk-rating of forests especially in relation to the effects of climate change. Modification of forest management. |
| 12 | Citrus longhorn beetle | *Anoplophora chinensis* (beetle) | **Long distance:** spread via movement of infested living (particularly potted trees/bonsai/penjing) or sawn wood **Locally:** Adult flight over relatively short distances (up to 2 km) | Control of movement of infested plants and wood to prevent long distance spread. Control of infestations by early detection and felling/destruction of infested trees. | Felling of infested trees. Trunk injection with imidacloprid or thiamethoxam. | Attacks usually near base of trunk of suitable hosts. Wide range of broadleaved trees, especially Acer spp., Aesculus hippocastanum, Citrus spp., Corylus spp., Cotoneaster spp., Cryptomeria japonica, Fagus spp., Ficus spp., Hibiscus spp., Lagerstroemia spp., Mallotus spp., Malus spp, Platanus spp., Populus spp., Prunus spp., Pyrus spp., Salix spp., Rosa spp., and Ulmus sppetc. First sign usually round exit hole. Small indentation from female chewing and oviposition only other external sign. Difficult to detect. | Die back of foliage during early attack phase. Sustained attacks can result in tree mortality. | Flight distances of adult beetles. Identification of potential natural enemies for possible classical biological control programmes. Early detection methods to be improved with increased discrimination between CLB and other species of longhorn and wood boring insects. | EUPHRESCO Anoplorisk research project involving UK (Fera & FR), Austria, Germany, France and Italy. Focus on early detection systems and adult dispersal, with options for direct intervention and control. Active research in USA and China (collaborative), with links being developed with Anoplorisk project. | Increased links with Chinese researchers, especially in relation to pest population dynamics and possibilities of identification of biological control agents. | Improvements in early detection to provide possible options for local eradication. Progress in use of chemical insecticide trunk injections to kill pest without felling trees. | Improved detection will facilitate direct intervention to eliminate local populations. | Biological control and possible trapping systems to detect adult movements. |
| 13 | Asian longhorn beetle | *Anoplophora glabripennis* (beetle) | **Long distance:** spread via movement of infested living or sawn wood, including wood-packaging material (WPM) **Locally:** Adult flight over relatively short distances (up to 2 km) | Control of movement of infested plants and wood (e.g. ISPM 15) to prevent long distance spread. Control of infestations by early detection and felling/destruction of infested trees. | Felling of infested trees. Trunk injection with imidacloprid or thiamethoxam. | Attacks usually in the upper part of trunks of suitable hosts. Similar host range to CLB (see above). First sign usually round exit hole. Small indentation from female chewing and oviposition only other external sign. Difficult to detect, particularly in the upper parts of the tree. | Die back of foliage during early attack phase. Sustained attacks can result in tree mortality. | Flight distances of adult beetles. Identification of potential natural enemies for possible classical biological control programmes. Early detection methods could be improved with increased discrimination from other species of longhorn and wood boring insects. | EUPHRESCO Anoplorisk research project involving UK (Fera & FR), Austria, Germany, France and Italy. Focus on early detection systems and adult dispersal, with options for direct intervention and control. Active research in USA and China (collaborative), with links being developed with Anoplorisk project. | Increased links with Chinese researchers, especially in relation to pest population dynamics and possibilities of identification of biological control agents. | Improvements in early detection to provide possible options for local eradication. Progress in use of chemical insecticide trunk injections to kill pest without felling trees. | Improved detection will facilitate direct intervention to eliminate local populations. | Biological control and possible trapping systems to detect adult movements. |
| 14 | Pine wood nematode | *Bursaphelenchus xylophilus* (nematode) | **Long distance:** spread via movement of infested living or sawn wood. Main risks are associated with presence of vector beetles in the genus *Monochamus* . **Locally:** Adult flight over relatively short distances (up to 2 km), but could be longer distances. | In areas where pine wilt expression occurs (linked to monthly isotherms >20oC and low soil moisture), early detection of wilt and felling of infested trees before emergence of vector beetles. Destruction or treatment of infested material to kill both nematode and vectors. | See left. There are no control measures applied in North America where the nematode is native and does not kill native trees other than occasionally in southern USA. | In wilt areas, rapid loss of oleoresin pressure and reddening of foliage, followed by tree death. Nematodes can be extracted from infested trees to confirm diagnosis. | Nematode lives in all species of conifer other than *Thuja,* Tsuga and *Taxus.* Massive loss of susceptible trees, especially pines, in areas where wilt expression occurs. Economic and environmental damage. | Precise flight distances of adult beetles. Extent of likely wilt expression in Europe under current and future climates. Possible non-vector transmission. More accurate early detection of infestation. | EU FP7 project REPHRAME commenced 1 March 2011. FR is coordinator and partners from Austria, China, France, Germany, Norway, Portugal, Spain. Some work under EU FP7 ISEFOR project (FR involved). | Links to research groups in Canada, Japan and USA where the nematode is present. Existing links with China through REPHRAME project. | Early detection methods will improve management of the pest in Europe, especially at the edges of current range. Management of vector beetle dynamics also important, as well as assessing the climate envelope for wilt expression. | High likelihood, building on previous PHRAME project and current programmes of research in Portugal and Spain. | Improved detection methods for both nematode and vector. |
| 15 | Ash die back | *Chalara fraxinea* (fungus) | **Long distance:** spread via movement of infected plant material. **Locally:** uncertain but possible through rain splash, wind, ?insects | Not known to be present in the UK, but movement of ash plants/timber from affected EU MS not currently regulated | None | **Well developed:** both in planta (convential and real time PCR) and for cultures (convential and PCR based) | **Ash: Potentially major;** bark death, dieback and mortality. In northern Europe many ash stands are affected and death widspread | Surveys of ash; nursery surveys; pathway analysis; epidemiology studies; ring testing of diagnostic protocols | None | Opportunities to work with scientists in affected European countries | | | |
| 16 | Pine pitch canker | *Gibberella circinata* (fungus) | **Long distance:** spread via movement of infected plant material and seed. **Locally:** Insect spread with longer distances via wind, wind-blown rain | Not known to be present in the UK; treatments aimed at preventing entry: import controls and inspection; kiln drying of timber | **In EU and USA:** Destruction of infected material; seed treatments; altered silviculture; selection of resistant pine species; sanitation of equipment | **Well developed:** both *in planta* (convential and real time PCR) and for cultures (convential and PCR based) | **Pine: Potentially major;** bark death causing girdling, dieback and mortality. Some trees show induced resistance after infection | Risk mapping to determine areas at most risk (climate/host maps); susceptibility of key pine spp under UK conditions; review of potential vectors; ring testing of diagnostic protocols | Diagnostic ring testing via EUPHRESCO project | Opportunities to work with scientists in affected European countries (Spain, Portugal) and USA | | | |
| 17 | Brown spot needle blight | *Mycosphaerella dearnessi (fungus)* | Long distance: infected plant material and potentially seed lots contaminated with needle debris. Locally: rain splash, wind, insects, forestry equipment, | Not known to be present in the UK; EC listed disease - import controls and inspection | silvicultural control i.e. burning to destroy infected needles; use of resistant species/provenances; Fungicide control e.g. chlorothalonil and Bordeaux mixture, benomyl and maneb; | Conventional and real time PCR. | In North America it causes serious growth check to seedlings and young trees, and has rendered Christmas tree plantations unsalable. It has recently been found affecting several pine species, including Scots pine, in a number of European countries e.g. Austria, CZ, Estonia, Slovenia, Switzeland | PRA specific to GB,; detection and diagnosis; risk mapping | None | Opportunities to work with scientists in affected European countries and USA | | | |
| 18 | Chestnut blight | *Cryphonectria parasitica* (fungus) | **Long distance:** spread via movement of infected plant material (plants, wood, bark) and birds. Small risk of transmission by fruits or seeds. **Locally:** Insect spread, splash dispersal via rain | Not known to be present in the UK; treatments aimed at preventing entry: import controls and inspection | In EU and USA: Destruction of infected material; use of hypovirulence where disease has established; sanitation of equipment | Convential PCR based method developed for *in planta* detection and authentication of isolates. Disease symptoms also very characterisc and well described. | **Potentially major**: has largely eliminated chestnut from its native range in North America and is damaging to productive chesnut orchards in much of Europe. | Risk mapping to determine areas at most risk (climate/host maps); host testing; testing of diagnostic protocols | None in the UK, other than limited annual surveys. Previous research has concentrated on timber use of chestnut and improved varieties | Opportunities to work with scientists in affected European countries and USA | | | |