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Pest Risk Analysis For *Chrysophtharta bimaculata* (OLIVIER)

STAGE 1: PRA INITIATION

1. What is the name of the pest?

Chrysophtharta bimaculata (Olivier) (Col: Chrysomelidae) — Tasmanian eucalyptus leaf beetle

2. What is the reason for the PRA?

There were four interceptions of this beetle in the UK in 2004. All the interceptions occurred in tree ferns (*Dicksonia antarctica)* imported from Australia. *C. bimaculata* is a pest of *Eucalyptus* plantations.

Date	Finding
15 June 2004	One dead adult (unsexed)
10 Nov 2004	One live adult (unsexed)
12 Nov 2004	One live adult (unsexed)
1 Dec 2004	One dead adult (unsexed)

3. What is the PRA area?

This PRA considers the whole EPPO region concentrating on the European and Mediterranean area, i.e. EPPO west of the Urals.

STAGE 2: PEST RISK ASSESSMENT

4. Does the pest occur in the PRA area or does it arrive regularly as a natural migrant?

C. bimaculata is not known to occur within the PRA area and does not arrive as a natural migrant.

5. Is there any other reason to suspect that the pest is already established in the PRA area?

No.

6. What is the pest's EU Plant Health Directive status?

Not listed. However, it is on the New Zealand list of regulated pests potentially associated with bark (Anon. 2003a) and those potentially associated with sawn wood (Anon. 2003b). *C. bimaculata* has also been included on lists of exotic pests that could arrive in the U.S.A. on eucalypt logs or wood chips imported from Australia (Kleijunas *et al.*, 2003).

7. What is the pest's EPPO Status?

Not listed.

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8. What are its host plants?

It occurs naturally on many *Eucalyptus* spp., including *E. regnans, E. obliqua, E. delegatensis, E. dalrympleana, E. nitens* and *E. globulus* (Elek, 1997, Elliot *et al.,* 1992).

9. What hosts are of economic and/or environmental importance in the PRA area?

There are large plantations of *Eucalyptus* spp. in Spain and Portugal, each of the countries was estimated to have plantations covering 550,000 ha in 1995. There are smaller areas of commercial plantation in other European countries including Britain, Ireland, France, Italy and Greece (Hodkinson, 1999 and website 1). Most of the wood from eucalypt plantations is used in the production of cellulose for paper, some is used for timber and there are small areas devoted to the production of cut foliage. *Eucalyptus globulus* is the preferred species grown for cellulose production (which is the most important use of *Eucalyptus*) and is a host of *C. bimaculata.* *Eucalyptus* trees are grown in nurseries in the UK and planted as ornamentals in the UK.

10. If the pest needs a vector, is it present in the PRA area?

No vector is required. This is a free living organism.

11. What is the pest's present geographical distribution?

North America:	Absent, no record
Central America & Caribbean:	Absent, no record
South America:	Absent, no record
Europe:	Absent (interceptions in UK as described in section 2)
Africa:	Absent, no record
Asia:	Absent, no record
Oceania:	Native to Australia in Tasmania and Victoria (Elek, 1997; Kleijunas *et al.*, 2003), only reported to be a pest in Tasmania

12. Could the pest enter the PRA area?

Yes. The pest has recently entered the PRA area as described in Section 2. In addition to the possibility of *C. bimaculata* arriving on *Dicksonia antartica* again, it could also arrive on imported ornamental *Eucalyptus* plants, cut foliage or timber. The risk of *C. bimaculata* arriving on *Dicksonia* in the UK is probably greater than in any other European country, because the UK is 'thought to import 90% of all tree ferns coming into Europe' (Anon, 2005). The most likely life stage of the beetle to arrive on imported tree ferns or *Eucalyptus* timber would be adults and could be difficult to detect because the beetles may be hidden deep in the crevices of the trunk. They would also be difficult to detect on imported eucalypt timber, because of the large volume of material that would need to be checked and the cryptic colouring of the beetle. The presence of *C. bimaculata* adults or larvae on ornamental plants is likely to be detectable due to damaged foliage, but eggs would be more likely to pass unnoticed.

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13. Could the pest establish outdoors in the PRA area?

Yes. The similarity in climate of the natural range of *C. bimaculata* and large parts of Europe and the existence in this area of *Eucalyptus* spp. ornamental trees and plantations suggests that there is a high probability that it could establish within the PRA area.

It is most likely that *C. bimaculata* could establish outdoors within the PRA area. The climate in Launceston, Tasmania (one of the areas with *Eucalyptus* plantations) was compared with locations in Europe using CLIMEX. CLIMEX gives a rating between 0 and 100 of how similar the climate in two different locations are, and it calculated Rennes in northern France (with a rating of 89) as the European location with a climate most closely matched with Launceston, Tasmania. The European locations that are rated as being most similar to Launceston, Tasmania are mainly in northern Europe, but is also include Soria, in north central Spain, in one of the important regions for *Eucalyptus* growing. *C. bimaculata* is believed to be a pest in all areas of *Eucalyptus* plantation in Tasmania and as the hosts *E. nitens* and *E. globulus* are grown over a range of climates in Tasmania, the former at higher altitude (Nahrung & Allen, 2004) and the latter in areas with more of a maritime climate, its distribution suggests it is able to survive in a range of climatic conditions.

On a world map of climatic zones, the habitat of *C. bimaculata*, Tasmania and Victoria are described as having a temperate oceanic climate (USDA, 1994). A large part of western Europe is also described as having a temperate oceanic climate, including the UK, Ireland, the Netherlands, Belgium, Switzerland, the northern coastal region of Spain, most of Germany, France excluding the Mediterranean region, and parts of northern Italy, Denmark and Norway.

There is a history of beetles that are closely related to *C. bimaculata* (within the same sub-tribe, see section 15), establishing themselves outside of their natural range. Two leaf beetles have become established in New Zealand, including *Paropsis charybdis* which has caused serious defoliation to some species of eucalypts for many years. *Trachymela tincticollis* has been a serious problem on coastal eucalypt plantations in South Africa (de Little, 1989). More recently (August 2003) *Chrysophtharta-m–fuscum* has been found on ornamental *E. globulus* trees in California (website 2).

14. Could the pest establish in protected environments in the PRA area?

If *Eucalyptus* infested with *C. bimaculata* or other plants such as *Dicksonia antartica* that the pest can hitch hike on, are imported from Victoria or Tasmania then there is a possibility that the pest could establish itself indoors. Establishment would only be possible in protected environments with a stock of susceptible *Eucalyptus* species, such at risk environments would include specialist producers of eucalypts and large indoor botanic gardens. The information available on the control of this species, refers to control in

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plantations to prevent economic injury, and there are no recorded attempts at eradicating it from protected environments.

15. How quickly could the pest spread within the PRA area?
Spread would be rapid in the eucalypt plantation areas of Spain and Portugal, but slow in areas with limited areas of eucalypt plantation such as the UK. The potential for spread of *C. bimaculata* would increase significantly in the UK if eucalypts plantations are established as a source of biofuel.

Kleijunas *et al.*, (2003) assessed the 'spread potential' of *Chrysophtharta* and *Paropsis* species in the USA to be moderate, this assessment was based on an anticipated rapid spread through a eucalypt plantation, but further spread would be restricted by the large distances between plantations.

C. bimaculata belongs to the sub-tribe of leaf beetles called Paropsina, commonly known as paropsines. Paropsines are herbivores on eucalypt trees and include *Trachymela tincticollis, T. sloanei and Paropsis charybdis.* In South Africa, *T. tincticollis* dispersed 1,330 km over 4 years. It was first detected in Cape Town in 1982 and is now a severe defoliator of coastal eucalypt plantations. Whereas in New Zealand, *T. sloanei* dispersed 30 to 40 km over 8 years. `The former spread of *T. tincticollis* could represent anthropogenic spread and that of *T. sloanei,* natural spread. *P. charybdis* spread through the North Island of New Zealand at an average rate of 60 km per year and the dispersal phase was believed to be the adults in the period before overwintering (Kleijunas *et al.*, 2003). The evidence from related species suggests that in an environments with large areas of suitable host trees, natural spread could be approximately 4 and 60 km per year, but actual spread could be a lot faster if there is an anthropogenic cause, for example the movement of timber between eucalypt plantations and paper mills.

16. What is the pest's potential to cause economic and/or environmental damage?
Given its pest status and the extensive *Eucalyptus* plantations in Portugal and Spain, the potential of *C. bimaculata* to cause economic damage in Europe is considered to be high. The overall environmental damage potential of *C. bimaculata* is considered to be low, because native ecosystems would not be affected.

C. *bimaculata* is a major pest of forestry plantations in Tasmania. This species is responsible for extensive defoliation of the main commercial eucalypt species, resulting in substantial losses in growth and, in severe cases, tree death (Elliot *et al.*, 1992). The larvae and the adults are both able to damage eucalypt trees. Larvae initially feed on new seasons' growth but can progress on to older leaves in later instars. Feeding by adult beetles in the autumn often prevents refoliation of the branches in the upper part of the crown leaving exposed shoots susceptible to damage from winter cold (Elliot *et al*., 1993). *C. bimaculata* can damage all ages of trees, but the most damage is done to young trees between 1m and 5m.

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Elliot *et al.* (1993) studied the effect of *C. bimaculata* on the growth of one and six year old *E. regnans* trees by excluding the beetle from some trees using an insecticide. At the end of the two year trial period the infested one year old trees had lost 45.6% of their potential height gain and the six year old trees had lost 50.4%. Elliot *et al.* concluded that if the damage that was recorded in their study was repeated annually over a normal pulpwood rotation (15-25 years), the plantation could not be expected to be profitable. Kile (1974) recorded defoliation by *C. bimaculata* of 60 year old *E. regnans* and *E. obliqua* of greater than 40%. Kleijunas *et al.*, (2003) rated the economic damage potential of leaf beetles in the USA as high.

There have been previous cases of non-indigenous insects threatening the viability of European euclaypt plantations. *Gonipterus scutellatus* (Coleoptera: Curculionidae) was discovered in South Africa in 1916 and subsequently spread through the eucalypt growing regions of Africa, France and Italy. It caused severe defoliation and threatened the viability of plantations (Ohmart & Edwards, 1991). After unsuccessful attempts at chemical control, success was achieved in South Africa by the introduction of an egg parasitoid, *Patasson nitens* (Hymenoptera: Mymaridae).

Spain and Portugal are the countries where there is the greatest potential for economic damage. Areas of Europe with an oceanic climate are likely to be at more risk from damage by this beetle than areas with a Mediterranean climate. The presence of *C. bimaculata* in Victoria, Australia and the lack of a pest problem there has a number of ecological explanations: there may be greater competition, greater predator pressure or it may be close to the edge of its climatic range. If the pest were to become established in Europe, there may well be a lack of effective natural enemies and the beetle may cause a greater level of damage than it does in Tasmania.

17. What is the pest's potential as a vector of plant pathogens?

There are no reported instances of *C. bimaculata* being a vector of plant pathogens.

STAGE 3: PEST RISK MANAGEMENT

18. What are the prospects for continued exclusion?

Good. The pathway of previous introductions into the UK (the import of *Dicksonia antartica*) that led to this PRA has come under considerable scrutiny by the UK and Australian governments in the first few months of 2005. The Australian government has agreed that future shipments of this tree fern will be held in a nursery for at least a year before shipment and hence the opportunities for controlling any insect pests before they leave Australia will improve. Other pathways of potential introduction of *C. bimaculata* are the import of potted *Eucalyptus* spp. trees, cut foliage and timber.

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Greece and The Azores (Portugal), have *Eucalyptus* protected zone for *Gonipterus scutellatus* (eucalyptus snout beetle), but it does not cover any of the paropsine beetles.

If *Eucalyptus* spp. trees are imported from an infected area with the bark attached, the risk of adult leaf beetles surviving international transport hidden under the bark is considered to be high (Kleijunas *et al.*, 2003), however, the frequency of the hiding behaviour of paropsine beetles is not known.

Eucalyptus spp. trees are grown for sale as ornamentals in the UK and in addition some are imported, but the origin and size of this trade is not known. There are also UK producers of *Eucalyptus* spp. cut foliage, most of them based in south west England, and some foliage is imported. Australia had a cut flower export market worth approx A$50 million in 2002 (equivalent to approx £22 million or €30 million on 31 March 2005) of which 11% was to the Netherlands and 3% was to Germany. Exports included cut foliage of *Eucalyptus* spp. (website 3).

In general, the probability of *C. bimaculata* arriving in Europe on ornamental trees is probably low because they should have been nursery grown. Also cut foliage should have been inspected for quality and hence insect damage before it leaves the exporting country. However, egg masses of *C. bimaculata that* are laid on the foliage would be difficult to detect. Both larvae and adult *C. bimaculata* feed on *Eucalyptus* spp. foliage. If larvae or adults have been present on foliage for any length of time, damage should be obvious, because larvae can eat whole leaves and the adults leave a scalloped pattern around the edge of the leaves.

The risk of establishment of a *C. bimaculata* population after arrival in the UK would depend on the import it arrived on, but for cut foliage it can be considered very low, on timber low, and on ornamental *Eucalyptus* spp. or tree ferns – moderate. The risk of establishment would be higher in parts of Europe with eucalypt plantations, especially where they ajoin domestic properties.

19. What are the prospects of eradication?

If *C. bimaculata* was discovered shortly after introduction on a small stand of eucalypts in the UK or areas of Europe where the trees are not widely grown in plantations then the prospects for eradication would be good. If the pest is discovered in a large plantation or in an area of large plantations in Portugal or Spain then the prospects of eradication would be poor, however the rate of natural spread is not known for this species.

20. What management options are available for containment and control?

Destruction of infested material if the pest is found on imports. If an outbreak is discovered on established trees, pesticide applications may be appropriate. Pyrethroid insecticides such as cypermethrin have been found to control the eggs larvae and adults of *C. bimaculata*, but they also have significant effects

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on the natural enemy population (Elliot *et al.*, 1992). *Bacillus thuringiensis* var *tenebrionis* (B.t.t.) trade name Novodor®, has been evaluated as a possible alternative to pyrethroids (Greener & Candy, 1994; Harcourt *et al.*, 1996; Elek & Beveridge, 1999; Beveridge & Elek, 2001). B.t.t. has been found to be less toxic to predatory insects than cypermethrin, but it is not effective against all life stages. More recently, spinosad, trade name Success®, has been evaluated as an alternative to pyrethroids (website 4). At rates that spinosad can control chrysomelid eucalyptus pests, it is much less toxic to beneficial and non-target arthropods.

In the longer term, if *C. bimaculata* became established in Europe, the planting of *Eucalyptus spp.* with some resistance to the pest could be considered as well as the introduction of natural enemies from Australasia as described for *G. scutellatus* in section 16.

CONCLUSION OF THE PEST RISK ANALYSIS

C. bimaculata is a serious pest of *Euclyptus* spp. trees in Tasmania. It could probably survive outside in much of Europe including the UK and has the potential to be a pest of the *Eucalyptus globulus* plantations in Portugal and Spain. The potential total economic consequences of establishment in the UK are low but the potential consequences of establishment in Spain or Portugal are high due to the large eucalypt plantations that are there. Imports of field collected *Dicksonia antartica* (tree ferns) or *Eucalyptus* trees, foliage or timber from Tasmania or Victoria into Europe provides a pathway for the entry of this beetle. The prospects of continued exclusion are considered to be good, because the only known EU interceptions have occurred on tree ferns and the Australian government has agreed that future shipments of *Dicksonia antarctica* will be nursery grown for at least a year.

UNCERTAINTIES AND FURTHER WORK

Section of PRA	Uncertainties	Further work that would reduce uncertainties
Taxonomy	None.	None.
Pathway	None.	None.
Distribution	Distribution and interception records within other EU / EPPO states is uncertain.	Contact other EU / EPPO states to ask for information about presence of the pest.
Hosts	None.	None.
Establishment	Suitability of climate in the UK/ EU for establishment.	More precise details of distribution of the pest in Tasmania.
Spread	Rate of spread if moved in trade.	
Impact	There are no specific data available describing host damage.	

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Management		

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APPENDIX 1

Eucalyptus plantations and ornamental plant production in Europe

Eucalyptus spp. are native to Australia, Indonesia, Papua New Guinea and the Philippines and all but two of the more than 500 species are found in Australia. The ability of eucalypts to grow in a wide variety of habitats, especially those poor in nutrients and water availability, has led to them becoming one of the most extensively planted tree genera in the world (Ohmart & Edwards, 1991).

Eucalyptus spp. trees are grown as ornamentals in the UK. The Royal Horticultural Society currently lists over 100 species of *Eucalyptus* that are available for sale in the UK at present or have recently been available (website 5) and the list includes all six of the species listed as hosts (see section 8 above). *Eucalyptus* is currently being evaluated in the field as a renewable energy source in the UK. Current evidence suggests that *Eucalyptus* could be a viable biomass crop in the UK (Purse & Richardson, 2001). There is now a financial incentive for renewable energy production in the UK which could lead to an increase in the planting of short rotation crops such as *Eucalyptus* for biomass production (website 6).

About 10 species of *Eucalyptus* are now widely cultivated in Europe (including Italy, France, Portugal, Ireland and the UK) for commercial production of

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foliage stems. None of the more commonly eucalypt species grown for the cut foliage market (website 7 and Anon, 1998) are known to be hosts of *C. bimaculata* therefore the risk of a major economic impact on this crop is considered to be low.

There are extensive *Eucalyptus* spp. plantations in Spain and Portugal, both countries were reported as having plantations totalling 550,000 ha each in 1995, this meant that only three countries in the world had larger areas of eucalypt plantations at that time (website 8). Using FAO figures from 2000 (website 9), 550,000 ha would represent 19% of the forest plantation area in Portugal and 4.4% of the forest plantation area in Spain.

The two most important *Eucalyptus* spp. grown in the Mediterranean region are *E. globulus* and *E. camaldulensis*. These two species are highly adaptive and grow rapidly in a wide range of climatic conditions (website 1). The ideal climate for *E. globulus* [outside Australasia] is said to be that of the eastern coast of Portugal, with no severe dry season, mean annual rainfall 900 mm, and minimum temperature never below -7°C (website 10). *E. globulus* is the most suitable eucalypt species that is grown in Spain for the production of cellulose (material for paper production) which is the main use of euclaypt timber and is the most extensively planted eucalypt species in the world. *E. camuldulensis* timber is better suited for construction which accounts for 15% of Spanish eucalypt production (website 11). *Eucalyptus* forests are the main source of raw material (wood and bark) for the Spanish pulp industry (website 12). *E. globulus* is a known host of *C. bimaculata* but *E. camuldulensis* is not reported as being a host.

On a global scale, *Eucalyptus* plantations may prevent some exploitation of non-renewable resources such as tropical hardwoods and if it proves valuable for biomass production this would assist efforts to provide energy from renewable sources. *Eucalyptus* trees are believed to grow well in Europe partly due to the absence of pests (13), but insect pests of *Eucalyptus* that arrive in Europe would be free of their natural enemies. The trees are not generally suitable food sources for indigenous herbivores and hence are of low ecological value when grown outside of their natural range. Eucalypt foliage has a number of features that make it unattractive and/or less than optimum food for [non-Australian] insect defoliators. It is sclerophyllous (hard-leaved), making it difficult to chew and possibly to digest due to excess fibre and it contains high concentrations of tannins, essential oils (terpenes), surface waxes and moderate to low levels of nitrogen. However [in Australia] eucalypts are subject to at least as much insect defoliation as other temperate tree species and they have a large number of species of insect defoliators associated with them (Ohmart, 1996). The planting of *Eucalyptus* plantations outside their native range has been criticised by a number of sources due to their low contribution to native biodiversity and the establishment of plantations in areas of ecological importance (14-17). There have also been cases of the high water consumption rate of eucalypts leading to a lowering of the water table and an increase in soil salinity (Binkley & Stape, 2004).