CSL Pest Risk Analysis For *Hemiberlesia rapax*

STAGE 1: PRA INITIATION

1. What is the name of the pest?

Hemiberlesia rapax (Comstock) Hemiptera greedy scale Diaspididae

Synonyms

Aspidiotus camelliae	*Aspidiotus tricolor*
Aspidiotus convexus	*Hemiberlesia argentina*
Aspidiotus lucumae	*Hemiberlesia rapax*
Aspidiotus rapax	

Notes on taxonomy:

This species was originally described by Comstock (1881) who placed it in the genus *Aspidiotus*. In 1938 Ferris transferred the species to *Hemiberlesia* (Ferris, 1938; Kosztarab, 1996). It can be difficult to distinguish between *H. rapax* and *H. lataniae* which is present under glass in the UK.

2. What is the reason for the PRA?

Since 1997 there have been over 20 detections of this organism in consignments of plants. Annex 1 summarises the detections in consignments between July 1997 and June 2005.

3. What is the PRA area?

This PRA considers the UK since the organism is already present in the EU.

STAGE 2: PEST RISK ASSESSMENT

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

No. *Hemiberlesia rapax* does not occur in the UK and does not arrive as a regular migrant.

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

Yes. The CABI Crop Protection Compendium 2005[1] states incorrectly that this organism is present in the UK. *Hemiberlesia rapax* does not occur in the UK (C. Malumphy, pers. comm.).

6. What is the pest's status in the European Union Plant Health Directive?[2]

Hemiberlesia rapax is not included in Council Directive 2000/29/EC.

7. What is the pest's status in the European and Mediterranean Plant Protection Organisation (EPPO)?

(www.eppo.org)

[1] http://www.cabi.org/compendia/cpc/index.htm

[2] http://europa.eu.int/eur-lex/en/consleg/pdf/2000/en_2000L0029_do_001.pdf

EPPO List:	A1 regulated pest list		A2 regulated pest list		Action list		Alert list	

Hemiberlesia rapax is not included on any EPPO lists.

8. What are its host plants?

H. rapax is a highly polyphagous organism. Dekle (1965) listed 92 hosts whilst Davidson & Miller (1990) listed 117 genera as hosts. Specific hosts include *Acer, Actinidia chinesis* (Chinese gooseberry), *Actinidia deliciosa* (kiwifruit), *Beilschmiedia tariari, Carya illinoinensis* (pecan) *Citrus, Griselinia, Knightia, Laurus, Olea, Osmanthus, Piper, Tillandsia* and *Vaccinium* (bluberry) as well as other woody ornamental hosts such as bamboo, palms, roses and vines.

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

Outdoors *Acer, Laurus*, *Rosa, Vaccinium* and *Vitis* are of economic and/ or environmental importance in the UK whilst in protection *Citrus, Olea* and Palmae are of economic importance.

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?

Hemiberlesia rapax is more or less pantropical and subtropical, being widely distributed across the USA, South and Central America, Africa, southern Europe, southern Asia and Oceania. Table 2 lists country distribution.

Table 2: Distribution of *Hemiberlesia rapax*

North America:	Mexico, USA (most states in the eastern half of the USA plus California & Washington)
Central America:	Guatemala, Honduras
South America:	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Peru, Uruguay
Caribbean:	Bermuda, Cuba, Jamaica
Europe:	France (in glasshouses), Italy (outdoors in Lazio & Sicily), Portugal, Spain
Africa:	Algeria, Kenya, Madagascar, Malawi, Seychelles, South Africa, Tanzania, Zambia, Zimbabwe
Asia:	India, Iran, Iraq, Japan, Malaysia, Pakistan, Russian Federation, Sri Lanka
Oceania:	Australia (South Australia, Tasmania, Victoria), New Caledonia, New Zealand, Papua New Guinea.

Source: CABI, 2005; Bianchi et al., 1994; Germain & Matile-Ferrero, 2005.

12. How likely is the pest to enter the PRA area?

Very likely [✓] Likely [ ] Unlikely [ ] Very [ ]

			unlikely
☐	☐	☐	☐

This pest has been detected in consignments on 22 occasions since July 1997. Annex 1 provides details.

13. How likely is the pest to establish outdoors in the PRA area?

Very likely	Likely	Unlikely	Very unlikely
☐	☐	✓	☐

Hemiberlesia rapax is unlikely to establish outdoors in the PRA area. The UK climate is too cool during the winter to sustain populations although in the summer transient populations may survive.

Hemiberlesia rapax is probably of tropical origin and now occurs widely in the subtropics and warmer regions of the world. In experiments investigating the thermal biology of *H. rapax* at constant temperatures, Blank *et al.* (2000) found that no individuals were able to complete development and reproduce at temperatures below 12.3°C. Table 3 shows the estimated developmental thresholds and thermal sums required for development of *H. rapax* life stages based on laboratory trials on populations from New Zealand (Blank *et al.,* 2000).

Table 3: Estimated developmental thresholds and thermal sums required for development of life stages of *Hemiberlesia rapax* (Blank *et al.,* 2000)

Life stage from - to	Threshold temperature for development (°C)	Day-degrees required to complete development of life stage
Egg to second instar	9.6	257
Second to third instar	9.7	552
Third instar to adult	10.3	882
Adult to reproductive maturity	10.6	992

Previously, Blank *et al*. (1996) had found that a threshold temperature for development of 9.3°C and a mean of 1,022 day-degrees were required for the summer generation and 1,114 day-degrees were required for the winter generation.

In regions where *H. rapax* occurs outdoors, such as in Oregon and California, there are two or more overlapping generations per year (Schuh & Mote, 1948; Gill, 1997).

14. How likely is the pest to establish in protected environments in the PRA area?

Very likely	Likely	Unlikely	Very unlikely
☐	✓	☐	☐

It is possible that *H. rapax* could establish in heated glasshouses in the UK. *H. rapax* can often be found in glasshouses elsewhere in the world but it seldom

becomes a major pest in such environments (CABI, 2005). *H. rapax* was reported from France in glasshouses in 2005 (Germain & Matile-Ferrero, 2005). Where it occurs in glasshouses there are multiple overlapping generations with all life stages present (Stimmel, 1987).

15. How quickly could the pest spread within the PRA area?
Very quickly [ ] Quickly [ ] Slowly [✓] Very slowly [ ]

Since *H. rapax* is unlikely to establish outdoors, spread leading to wider establishment is most likely to occur only between glasshouses with the movement of infested plants in trade being the major mechanism for spread. Local spread within glasshouses can occur with juvenille crawler stages moving from one host to another. Air currents or insects can also spread *H. rapax* (CABI, 2005).

16. What is the pest's potential to cause economic and/or environmental damage in the PRA area?

Low. Woody ornamental hosts grown in heated glasshouses where the temperature does not drop below 12.3°C could be at risk from *H. rapax*.

In tropical and subtropical regions *H. rapax* is a major pest of fruit and woody ornamental plants. Greedy scale is an important quarantine pest on kiwifruit in New Zealand, and in some years has been the major cause of rejection of fruit for export (Blank *et al.*, 1987). *H. rapax* can often cause leaf yellowing, premature leaf drop, and dieback. Although this species has been in Italy for several years, and is an occasional pest of *Citrus*, it is considered of little economic importance there (Bianchi *et al*., 1994).

17. What is the pest's potential as a vector of plant pathogens?
Hemiberlesia rapax is not recorded as a vector of plant pathogens.

Summary of risk assessment
Hemiberlesia rapax is a polyphagous scale insect widely distributed across the tropics and subtropics. It is found outdoors in Italy where it is considered of little economic importance. It is also found outdoors in Spain and Portugal and in glasshouses in France.

Since 1997 *H. rapax* has been detected in the UK on over 20 occasions during PHSI inspections. *H. rapax* is unlikely to establish outdoors in the UK but could possibly establish under glass on woody ornamentals such as Acers, bamboo, bay, olives, palms and vines.

STAGE 3: PEST RISK MANAGEMENT

18. What are the prospects for continued exclusion?
Outdoors: Good. The unsuitable climate of the UK is likely to prevent *H. rapax* from establishing outdoors.

In protection: Fairly good. Pest management regimes targeted against existing scale insects will inhibit establishment.

19. What are the prospects of eradicating an outbreak?

Good. Previous outbreaks under glass have been eradicated using fatty acids, malathion and pyrethroids (CSL unpublished). Such soap-pyrethroid combinations have been found to be c. 70% effective against adults and immatures of *H. rapax* (Hansen *et al*. 1992). These contact insecticides target the crawler stage. Insect growth regulators, such as buprofezin, are also effective against the immature stages of the pest and may be used as an alternative treatment.

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

Effective control has been obtained using biological control agents, chemicals, insect growth regulators (for immatures) and mineral oil. Mineral oil has a lower toxicity compared with chemical compounds (Blank *et al*., 1993) and can be one of the most selective pesticide available, if treatments are timed to coincide with the end of maximum crawler emergence. Physical removal of scales by scraping or scrubbing with a knife or wire brush is also an acceptable alternative. Soil applications of the systemic insecticide, imidacloprid, will not provide long-term control of *H. rapax*.

Armoured scales such as *H. rapax* are spread via movement of nursery stock, so measures should be taken to ensure that only propagative material that is free of scales should be planted. Adequate plant spacing is also important to ensure that the scales do not spread from plant to plant, which can happen if the the plants are in contact (Beardsley & Gonzalez, 1975). As plants grow, pruning maintains spacing and allows maximum coverage when using insecticides.

Biological control agents are used to suppress *H. rapax* in some countries, but only generalist predators such as the green lacewing (*Chrysoperla carnea*) are available in the UK, and are unlikely to contain an outbreak.

FURTHER WORK THAT WOULD REDUCE UNCERTAINTIES

Section of PRA	Area of uncertainty	Potential work required to reduce uncertainty
Taxonomy	None.	-
Pathway	Many routes into the PRA area exist but specific examples of pathways to heated glasshouses with hosts are not known.	Ask PHSI for examples of possible pathways
Distribution	Could be spreading in southern Europe	Ask EU MS for information about this pest.
Hosts	Exact limit of host range	
Establishment	Do heated glasshouses	Ask PHD to ask grower

	with hosts stay above 12C during the winter?	groups for information.
Spread	Rate of spread	Develop model for spread in trade
Impact	Value of hosts at risk	Ask PHD to ask grower groups for information.
Management	What methods may be available in organic situations?	

REFERENCES

Beardsley JW Jr, Gonzalez RH. 1975. The biology and ecology of armored scales. *Annual Review of Entomology* **20**, 47-73.

Bianchi A, Pacchiacucchi A, Guarino L, Maffeo E, 1994. Record of a new scale insect on kiwifruit in Lazio. *Informatore Agrario*, **50** (46):73-75.

Blank BH, Gill GSC, Kelly JM. 2000. Development and mortality of greedy scale (Homoptera: Diaspididae) at constant temperatures. *Environmental Entomology,* **29** (5), 934-942.

Blank RH, Olson MH, Lo PL, 1993. Mineral oil and diazinon to control armoured scale on kiwifruit. *Proceedings of the Forty Sixth New Zealand Plant Protection Conference, 10-12 August 1993*, 71-74.

Blank RH, Gill GSC, Upsdell MP, 1996. Greedy scale, *Hemiberlesia rapax* (Hemiptera: Diaspididae), phenology on kiwifruit leaves and wood. *New Zealand Journal of Crop and Horticultural Science*, **24** (3):239-248.

CABI, 2005. Crop Protection Compendium, CABI, Wallingford.

Comstock JH, 1881. Annual Report Department of Agriculture for 1880. Report of the entomologist of the United States Department of Agriculture for the year 1880, Part II - Report on scale insects. USA: USDA, 276-349.

Davidson JA, Miller DR, 1990. Ornamental plants. In: Rosen D, ed. *Armoured Scale Insects, their Biology, Natural Enemies and Control*. Vol. 4B. Amsterdam, Netherlands: Elsevier, 603-632.

Dekle GW, 1965. Arthropods of Florida and neighboring land areas. Florida, USA: Florida Department of Agriculture, Division of Plant Industry.

Ferris GF, 1938. *Atlas of the Scale Insects of North America*, Series II: Diaspididae. Stanford, USA: Stanford University Press, 137-268.

Germain JF, Matile-Ferrero D. 2005. Scale insects from greenhouses in France: an illustrated survey. III - Diaspididae. *Phytoma*. **583**, 32-35.

Gill RJ, 1997. The scale insects of California. Part 3. The armoured scales (Homoptera: Diaspididae). Technical Series in Agricultural Biosystematics and Plant Pathology, No 3. Sacramento, USA: Department of Food and Agriculture.

Hansen JD, Hara AH, Tenbrink VL. 1992. Insecticidal dips for disinfesting commercial tropical cut flowers and foliage. *Tropical Pest Management* **38**, 245-249.

Kosztarab M, 1996. Scale Insects of North Eastern North America: identification, biology, and distribution. Martinsville, USA: Virginia Museum of Natural History, 650 pp.

Schuh J, Mote DC, 1948. Insect pests of nursery and ornamental trees and shrubs in Oregon. *Oregon State Experiment Station Bulletin*, 449:164.

Stimmel JF, 1987. The Scale Insect of Pennsylvania Greenhouses. Harrisburg, USA: Pennsylvania Department of Agriculture, Bureau of Plant Industry.

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Annex 1

Table A1: The number of consignments on hosts imported into England & Wales on which *Hemiberlesia rapax* have been detected and their country of origin

Host / Country of Origin	*Acer*	*Laurus*	unknown	*Citrus*	*Griselinia*	*Knightia*	*Olea*	*Osmanthus*	*Piper*	*Tillandsia*	Sub-total
New Zealand	7				1	1					9
Portugal		4									4
Unknown			1					1			2
Chile			1								1
Guatemala										1	1
India									1		1
Italy		1									1
NL							1				1
South Africa				1							1
UK			1								1
	7	5	3	1	1	1	1	1	1	1	22