Review of garden plants resistant to Phytophthora soil fungus in Western Australia

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Garden plants resistant to *Phytophthora cinnamomi* (July 2004)

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This report summarises the procedures used to develop a brochure on native Australian species used in horticulture that are resistant or susceptible to dieback (*Phytophthora cinnamomi*) for the West Australian nursery industry.

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July 2004

Media summary

To enable informed choice of Australian species for gardens and amenity areas in soils infested with *Phytophthora cinnamomi*, a summary was made of all reports of native species resistant or susceptible to the pathogen. Species were mostly those native to Western Australia. A brochure was produced that lists the resistant species while a list of the susceptible species is available on the website http://www.cpsm.murdoch.edu.au/. The degree of confidence for the designation of resistance or susceptibility is indicated. This depends on whether species have been subjected to inoculation with the pathogen under controlled glasshouse conditions, inoculation in the field, or whether resistance or susceptibility is assumed from the survival or death of the species in areas where the pathogen is active. The brochure is available from Mr Sandy Pate: Nursery and Garden Industry of WA, 2, Somersby Rd Welshpool 6106.

Technical Summary

A review of publications, unpublished theses and Departmental and Company records was undertaken to update the 1989 Department of Conservation and Land Management Bulletin by Roger Edmiston on 'Plants Resistant to Dieback'. Species were categorised into those in which the level of resistance was known from inoculation under glasshouse conditions, or inoculation in the field, and those for which resistance or susceptibility is assumed because of their survival or death in the field where the pathogen is active. Production lists from the major Western Australian nurseries producing native species were used to identify species commercially available and 118 of these were classified as resistant to *Phytophthora*. The survey of records for all Western Australian species identified 297 susceptible, and 224 resistant species. For only 15% of susceptible, and 7% of resistant species had the determination of susceptibility or resistance been checked using controlled inoculations and recovery procedures under glasshouse conditions.

Garden plants resistant to *Phytophthora cinnamomi*

Introduction

Phytophthora cinnamomi is a soil borne plant fungal pathogen causing the disease known as 'dieback disease' or 'jarrah dieback'. Early settlers introduced the fungus into Australia and it has long been recognized as a serious threat to the flora of Western Australia. It has a wide host range and the name 'jarrah dieback' is misleading as it can kill many species in the forest, woodland and sandplain communities in the south-west of Western Australia. Up to 22% of the plant species of the southwest may be susceptible. There are however a number of species that are resistant as they are observed to survive in the field in the presence of the fungus or have been tested for resistance under controlled conditions.

Australian native species are increasing in popularity for West Australian home gardens and amenity landscaping as well as being essential for land rehabilitation. In areas experiencing drought, native species are being promoted to minimise water use. Many park and garden areas are infested with *Phytophthora cinnamomi* either through development of infested land, or through accidental transfer of the pathogen on plants, soil or firewood. Consequently home gardeners, landscapers and people undertaking rehabilitation work need information about which native species are susceptible or resistant to the pathogen. As home gardeners do not usually distinguish between Western Australian species and those from the eastern states when buying 'native species', information on eastern species on sale in WA is also needed.

At present customers choosing plants at a nursery have little chance of knowing if the plants they are buying might survive in a *Phytophthora* infested area. The most recent listing of resistant species was in a Department of Conservation and Land Management brochure (1989) which is not widely available. Since 1989 further information has become available but much of it is unpublished in departmental or company records.

The purpose of this work was to collate the data on susceptibility and resistance from diverse sources and make it available to the public in two forms – a brochure listing resistant species, and a website listing both susceptible and resistant species. An initial plan to write a scientific paper of the findings was not followed up as, after commencing we discovered a recent summary by Shearer (2003), and also that Dr David Cahill (Deakin University) (Cahill et al. 2004) was already writing a review on that topic. Our information was passed on to Dr Cahill.

Materials and Methods

A search of published papers, theses, departmental and company records, and interviews of key researchers was undertaken to gain information on Western Australian species susceptible or resistant to *Phytophthora*. Species from other Australian states that are sold in WA nurseries were also included. For the brochure on resistant species, only those sold by nurseries were included. For the website, a complete listing of species was produced whether or not they are currently used in horticulture.

The information about whether a species is susceptible to *Phytophthora* can result from glasshouse inoculation experiments done under carefully controlled conditions, or from field inoculations that are done under more natural but uncontrolled environmental conditions. Finally there is a large body of information from field observations regarding species that die or survive as a disease front moves through the vegetation. This information is valuable, but the least reliable, as species may die not from exposure to the pathogen, but because of altered conditions that apply after the pathogen has killed much of the biomass – eg they could die from increased exposure or waterlogging. To be sure a species has died of Phytophthora it is necessary to reisolate the pathogen from the dead plant. Consequently the source(s) of information on each species was categorised so users of the brochure or the website have an indication of the reliability of the information.

The common names, horticultural attributes and state of origin were also collated for the resistant species, from information from nurseries' websites and 'Encyclopaedia Botanica' (Bodkin 1986).

Results

We were able to identify 118 native Australian species in production by WA nurseries that were resistant to dieback. This considerably extends the 1989 list (Edmiston 1989) as many of the species in that list were not available in nurseries. This information was produced as a brochure.

The survey of all Western Australian species for which there are records of disease response (Appendix 1 & 2) show that for surprisingly few there have been controlled glasshouse experiments to confirm resistance or susceptibility (Table 1). Most of the records are drawn from field observations and there is also a considerable number of species in the literature for which the evidence for their classification is not known.

Table 1. Evidence used to determine the susceptibility or resistance of species to *Phytophthora cinnamomi.*

	No. of species	
Source of information	Susceptible	Resistant
Field observations	132	118
Field observations and recovery	62	83
Glasshouse inoculation and recovery	43	16
Field inoculation and recovery	18	
Not stated	41	7
total	296	224

Discussion

It is frequently stated that the plant species that remain after the passage of a dieback front lack colour and diversity. For gardeners it is encouraging to find that the list of resistant horticultural species includes many favourites from colourful families such as

Haemodoraceae, Myrtaceae, Fabaceae and Mimosaceae. Never-the-less the list of susceptible species is very much larger than that for the resistant species. The number of resistant species for which resistance has been confirmed under controlled conditions is small. Inoculation under glasshouse conditions and re-isolation of the pathogen is necessary to fulfil Koch's postulate. More glasshouse work to accurately assess the level of resistance of important horticultural species is required. One important point is that environmental conditions can affect the level of susceptibility of a species. A species that is normally resistant may be susceptible when grown under waterlogging or other stress conditions.

The acceptance of the brochure by the industry indicates that it is serving its desired function for horticulturists and home gardeners.

Technology Transfer

The brochures have been distributed by the following
Mr Sandy Pate, Nursery and Garden Industry of WA,
Mr B Groom, Domus Nursery,
Alex and Jackie Hooper, Zanthorrea Nursery,
Mark Webb, Kings Park and Botanic Gardens,
Bob Lulfitz , Lulfitz Nursery,
Chris Dunne, and Loretta Bean, Kalamunda Shire,
Dr Mike McCall,

The brochure has been available at Garden Week and Dieback meetings, and Sandy Pate has sent copies to nurserymen, landscapers garden centres and journalists. It has been well received and supplies from the first print run will be exhausted by about August.

The complete list of susceptible and resistant Western Australian species is available on the website of the Centre for Phytophthora Science and Management at Murdoch University http://www.cpsm.murdoch.edu.au/.

Recommendations

When funds become available after submission of the final report to HAL further brochures will be printed. The second print run will be able to include the website address.

Acknowledgements

We are pleased to acknowledge the financial support of Dr Mike McCall and Horticulture Australia. We also thank Alcoa of Australia, Dr Bryan Shearer and Dr Ray Wills who gave access to unpublished information, and Mr B. Groom, Mr Bob Lulfitz, Alex and Jackie Hooper provided information about nursery production lines, and Jackie Hooper the photos for the brochure.

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Appendix 1 Western Australian Natives Resistant to *Phytophthora cinnamomi.*

Compiled by E. Groves, G. Hardy & J. McComb, Murdoch University

***Information used to determine resistance to* P. cinnamomi** *: 1a- field observations, 1b- field observation and recovery of* P.cinnamomi*; 2a- glasshouse inoculation of* P. cinnamomi *and recovery, 2b- field inoculation with* P. cinnamomi *and recovery. Not Provided- no information was provided from the reference.*

PLANT SPECIES	COMMON NAME	ASSESMENT	NURSERY AVALABILITY	REFERENCES
Acacia barbinervis Benth.		1b		12, 15
Acacia baxteri Benth.	Baxter's Wattle	1a		19
Acacia browniana H.L. Wendl.		1b		15
Acacia browniana var *intermedia* (E.Pritz)Maslin.		1a		20
Acacia cyclops G.Don.	Coastal Wattle	1a	A	20
Acacia drummondii Lindl.	Drummond's Wattle	1b	A	15
Acacia extensa Lindl.	Wiry Wattle	1b		15
Acacia huegelii Benth.		1b		16
Acacia lateriticola Maslin.	Rib Wattle	1b		12, 15
Acacia nervosa D.C.		1b		12, 15
Acacia preissiana (Meisn.) Maslin.		1b		15
Acacia pulchella R. Br.	Prickly Moses	2a	A	5, 17
Acacia saligna (Labill.) H. L. Wendl.	Orange Wattle	1b	A	16
Acacia semitrullata Maslin.		1b		16
Acacia urophylla Lindl.		1b	A	12, 14, 15
Agonis flexuosa (Willd.) Sweet.	Peppermint	1b	A	16
Agonis juniperiana Schauer.	Wattie	NP		10
Allocasuarina lehmanniana (Miq) L.A.S. Johnson	Dune Sheoak	1a		20
Allocasuarina humilis (Otto & F.Dietr.) L.A.S Johnson	Dwarf Sheoak	1a	A	20
Allocasuarina microstachya (Miq) L.A.S. Johnson		1a		20
Anarthria gracilis R.Br.		1a		20
Anarthria prolifera R.Br.		1a		20
Anarthria scabra R.Br.		1a		20
Anigozanthos flavidus Red et. B.C	Tall Kangaroo Paw	2a	A	17
Anigozanthos manglesii D. Don.	Mangle's Kangaroo Paw	2a	A	16, 17
Anigozanthos rufus Labill.	Red Kangaroo Paw	2a	A	17
Astartea heteranthera		1a	A	5, 10
Astartea fascicularis (Labill.)DC.		1a	A	20
Astroloma pallidum R. Br.	Kick Bush	1b		12, 15
Baeckea pachyphylla (Benth.)		1a		20
Baeckea camphorosmae Endl.	Camphor Myrtle	1b	A	5, 12, 15, 16

Billardiera drummondiana (Putt.) E.M. Benn.		1b		15
Billardiera variifolia D.C.		1b		16
Boronia crenulata (Sm.)	Aniseed Boronia	1a	A	20
Boronia spathulata Lindl.	Boronia	1b		15
Bossiaea linophylla R.Br.		1a		20
Bossiaea rufa R.Br.		1a		20
Bossiaea webbii F.Muell.	Water Bush	1a	A	20
Burchardia multiflora Lindl.	Dwarf Burchardia	1a		20
Burchardia umbellata R.Br.	Milkmaids	1a		20
Calothamnus affinis v longistamineus Turcz		1a		20
Calothamnus quadrifidus R.Br.	One-sided Bottle Brush	1a	A	20
Calothamnus sanguineus Labill.	Silky-leaved Blood Flower	1a	A	20
Calytix asperula (Schauer) Benth.	Brush Starflower	1a		20
Calytrix flavescens A. Cunn.	Summer Starflower	1b		20
Calytrix leschenaultii (Schauer) Benth.		1a		20
Calytrix tenuiramea (Turcz)Benth.		1a		20
Cassytha flava Ness.	Dodder Laurel	1b		16
Cassytha glabella R. Br.	Tangled Dodder Laurel	1b		16
Casuarina obesa Miq.	Swamp Sheoak	1a	A	5, 10
Caustis dioica R.Br.		1a		20
Chamaexeros serra (Endl.) Benth.	Little Fringed Leaf	1a		20
Chorizema aciculare (D.C.) C.A. Gardner	Needle-leafed Chorizema	1a		20
Clematis pubescens Endl.	Common Clematis	1b		12, 15
Comesperma calymega Labill.	Blue-spiked Milkwort	1a		12
Comesperma confertum Labill.		1a		20
Comesperma virgatum Labill.	Milkwort	1b		12, 15
Conostylis aculeata R. Br.	Prickly Conostylis	1b	A	15, 16
Conostylis pusilla Endl.		1b		15
Conostylis serrulata R. Br.		1b		12, 15, 16
Conostylis setigera R.Br.	Bristly Cottonhead	1a		20
Conostylis setosa Lindl.	White Cottonhead	1b		12, 15
Corymbia calophylla K.D. Hill & L.A.S. Johnson	Marri	2a	A	5, 12, 14, 15, 16, 17
Cryptostylis ovata R.Br.	Slipper Orchid	1a		20
Cyathochaeta avenacea (R.Br.) Benth.		1a		20
Cyathochaeta clandestina (R. Br.) Benth.		1b		15
Dampiera linearis R. Br.	Common Dampiera	1b		12, 16
Darwinia citriodora (Endl.) Benth.	Lemon-scented Darwinia	1a	A	5, 10
Darwinia leiostyla (Turcz) Dorman		1a	A	20
Darwinia vestita (Endl.)Benth.	Pom Pom Darwinia	1a		20
Desmocladus fasciculatus (R. Br) B.G. Briggs& L.A.S. Briggs		1b		16
Desmocladus flexuosa (R. Br) B.G. Briggs & L.A.S. Briggs		1b		16
Dodonaea viscosa Jacq.	Sticky Hopbush	2a	A	5, 10
Drosera erthrorhiza Lindl.	Red Ink Sundew	1a		20
Drosera pallida Lindl.	Pale Rainbow	1a		20
Eriochilus dilatatus Lindl.	White Bunny Orchid	1a		20

Eriostemon spicatus A. Rich.	Pepper and Salt	1b	A	15, 16
Eucalyptus accedens W Fitzg.	Powderpark Wandoo	2a	A	5, 17
Eucalyptus angulosa Schauer	Ridge-fruited Mallee	1a		20
Eucalyptus astringens (Maiden) Maiden	Brown Mallee	NP		5
Eucalyptus buprestium F.Muell.	Apple Mallee	1a		20
Eucalyptus camaldulensis Dehm.	River Gum	2a	A	5, 17
Eucalyptus conferruminata D.J. Carr & S.G.M. Carr	Bald Island Marlock	1a	A	5
Eucalyptus falcata Turcz	Silver Mallet	1a		20
Eucalyptus forrestiana Diels.	Fuchsia Gum	1a	A	5
Eucalyptus gardneri Maiden	Blue Mallet	1a		5
Eucalyptus gomphocephala D.C.	Tuart	2a	A	5, 17
Eucalyptus incrassata Labill.	Lerp Mallee	NP	A	10
Eucalyptus kruseana F. Muell.	Bookleaf Mallee	2a	A	5, 10, 17
Eucalyptus laeliae Podger & Chippend	Darling Range Ghost-Gum	2a	A	5, 10, 17
Eucalyptus lehmanniii (Schauer) Benth.	Bushy Yate	2a	A	19
Eucalyptus megacarpa F. Muell.	Bullich	2a	A	5, 10, 17
Eucalyptus occidentalis Endl.	Flat-topped Yate	2a	A	5, 10, 17
Eucalyptus pachyloma Benth.	Kalgan Plains Mallee	1a		20
Eucalyptus patens Benth.	Swan River Blackbutt	1a		5
Eucalyptus preissiana Schauer	Bell Fruited Mallee	1a	A	20
Eucalyptus rudis Endl.	Flooded Gum	1a	A	5, 17
Eucalyptus salmonophloia F. Muell.	Salmon Gum	NP		10
Eucalyptus spathulata Hook.	Swamp Mallet	1a		5
Eucalyptus uncinata Turcz	Hook-leafed Mallee	1a		20
Eucalyptus wandoo Blakey.	Wandoo	2a	A	5, 10, 17
Gahnia trifida Labill.	coast Saw-Sedge	1a		20
Gompholobium capitatum A. Cunn.		1b		15
Gompholobium tomentosum Labill.	Hairy Yellow Pea	1b	A	16
Goodenia caerulea R.Br.		1a		20
Goodenia scapigera R.Br.	White Goodenia	1a		20
Grevillea fasciculata var linearis R.Br.		1a		20
Grevillea hookeriana Meisn.	Red Toothbrushes	1a	A	5, 10
Grevillea synapheae R. Br.	Catkin Grevillea	1b	A	15
Haemodorum paniculatum Lindl.	Mardja	1b		16
Hakea amplexicaulis R. Br.	Prickly Hakea	1b		15
Hakea corymbosa R. Br.	Cauliflower hakea	1a		20
Hakea lissocarpha R. Br.	Honey Bush	1b	A	12, 15, 16
Hakea petiolaris Meisn.	Sea Urchin Hakea	1a	A	5, 10
Hakea scoparia Meisn.		NP	A	10
Hardenbergia comptoniana (Andrews) Benth.	Native Wisteria	1b	A	10, 16
Hemiandra pungens R. Br.		1b	A	16
Hemigenia curvifolia F. Muell.	Snakebush	1b		15
Hibbertia silvestris Diels.		1b		15
Hibbertia racemosa (Endl.) Gilg.	Stalked Guinea Flower	1b		16
Hibbertia vaginata (Benth.) F. Muell.		1b		16
Hovea chorizemifolia (Sweet) DC.	Holly-leaved Hovea	1b		12, 15

Hovea trisperma Benth.	Common Hovea	1b	A	16
Hypocalymma angustifolium (Endl.) Schauer	White Myrtle	1b		12, 15, 16
Hypocalymma myrtifolium Turcz		1a		20
Hypocalymma speciosum Turcz		1a		20
Isotoma hypocrateriformis (R.Br.) Druce.	Woodbridge Poison	1a		12
Johnsonia lupulina R.Br.	Hooded Lily	1a		20
Johnsonia teretifolia Endl.	Hooded Lily	1a		20
Kennedia coccinea Vent.	Coral Vine	1b	A	15
Kennedia prostrata R. Br.	Scarlet Runner	1b	A	10, 15
Kunzea preissiana Schauer		1a		20
Lechenaultia biloba Lindl.	Blue Lechenaultia	1b	A	12, 15
Lepidosperma scabrum Nees.		1b		15
Lepidosperma squamatum Labill.		1a		12
Lepidosperma tenue Benth.		1b		15
Lepidosperma tetraquetrum Nees		1a		14
Lepidosperma viscidum R.Br.	Sticky Sword Sedge	1a		20
Leporella fimbriata (Lindl.) A.S. George	Hare Orchid	1a		20
Leptocarpus tenax (Labill.) R.Br.	Slender Twine Rush	1a		20
Leptomeria cunninghamii Miq.		1b		15
Leptomeria eriocoides Miq.		1a		20
Leptospermum erubescens Schauer	Roadside Teatree	1a		20
Leucopogon glabellus R.Br.		1b		16
Leucopogon pendulus R.Br.		1a		20
Levenhookia pusilla R.Br	Midget Stylewort	1a		12
Linsaea linearis SW.	Screw Fern	1a		20
Lobelia gibbosa Labill.	Tall Lobelia	1a		20
Lobelia rhytidosperma Benth.	Wrinkled-Seeded Lobelia	1a		12
Logania serpyllifolia R.Br.		1a		20
Lomandra integra T. Macfarlane		1b		16
Lomandra nigricans T. Macfarlane		1b		16
Lomandra pauciflora (R.Br.) Ewart.		1a		20
Lomandra preissii (Endl.) Ewart.		1a		20
Lomandra sonderi (F. Muell.) Ewart.		1b		16
Lyginia barbata R.Br.		1b		16
Macropidia fuliginosa (Hook) Druce.	Black Kangaroo Paw	2a	A	17
Meeboldina scariosa (R.Br) B.G. Briggs & L.A.S. Briggs.		1b		16
Melaleuca suberosa (Schauer) C.A. Gardner	Corky Honeymyrtle	1a		20
Melaleuca cuticularis Labill.	Saltwater Paperbark	1a	A	20
Melaleuca diosmifolia Andrews.		1a	A	5, 10
Melaleuca holosericea Schauer		1a		19
Melaleuca lanceolata Otto.	Rottnest Teatree	1a	A	5, 10
Melaleuca laxiflora Turcz.		1a		14
Melaleuca leucadendron	Cadjeput	1a	A	5, 10
Melaleuca macronychia Turcz.		1a		5

Melaleuca nesophila F. Muell.	Mindiyed	1a	A	5, 10
Melaleuca pentagona Labill.		1a	A	5, 10
Melaleuca preissiana Schauer	Moonash	1b	A	16
Melaleuca pulchella R. Br.	Claw Flower	1a	A	5, 10
Melaleuca spathulata Schauer.		1a	A	5, 10
Melaleuca violacea Schauer.		1a	A	5, 10
Mesomelaena graciliceps (C.B. Clarke) K.L. Wilson		1a		12
Mesomelaena stygia (R.Br.) Nees		1a		20
Mesomelaena tetragona (R.Br.) Benth.	Semaphora Sedge	1b		15, 16
Millotia tenuifolia Cass.	Soft Millotia	1a		12
Mirbelia dilatata R.Br.	Holly-leaved Mirbelia	1b	A	15
Myoporum insulare R.Br.	Blueberry Tree	NP	A	10
Eucalyptus decurva F.Muell.	Slender Mallee	1a		20
Nuytsia floribunda (Labill.) Fenzl.	Christmas Tree	1b	A	16
Olax phyllanthi (Labill.) R.Br.		1a		20
Opercularia echinocephala Benth.	Bristly Headed Stink Weed	1b		12, 15
Orthrosanthus laxus (Endl.) Benth.	Morning Iris	1b	A	16
Paraserianthes lophantha (Willd). Benth.	Albizia	NP		10
Patersonia pygmaea Lindl.	Pygmy Patersonia	1b		12, 15
Pentapeltis peltigera (Hook) Bunge.		1b		12, 15
Persoonia aff. *saccata* R.Br.	Snottygobble	1b		16
Phlebocarya ciliata R.Br.		1b		16
Phyllanthus calycinus Labill.	False Boronia	1b	A	12, 15
Pimelea hispida R.Br.	Bristly Pimelia	1a		20
Pittosporum phyllraeoides D.C.	Weeping Pittosporum	1a	A	5
Platysace tenuissima (Benth.) C. Norman		1b		15
Poa poiformis (Labill.) Druce	Coastal Poa	1a	A	17
Pteridium esculentum (G.Frost) Cockayne	Bracken	1a		20
Ptilotus manglesii (Lindl.) F. Muell.	Pom Poms	1b		15
Pultenea ericifolia Benth.		1a		20
Restio confertospicatus (Steud.) B.G. Briggs & L.A.S. Johnson		1a		20
Scaevola striata R.Br.	Royal Robe	1b		15
Schoenus curvifolius (R.Br.) Roem & Schult		1b		16
Schoenus pdicellatus (R.Br.) Benth.		1a		20
Schoenus rigens S.T. Blake		1b		16
Stipa compressa (R.Br.) S.W.L. Johnson & J. Everett		1a		20
Stylidium brunonianum Benth.	Pink Fountain Triggerplant	1a		20
Stylidium imbricatum Benth.	Tile leafed Triggerplant	1a		20
Stylidium piliferum subsp minor (Mildbr.) Carlquist		1a		20
Stylidium scandens R. Br.	Climbing Triggerplant	1a		20
Stylidium scandens R.Br.	Climbing Triggerplant	1a		12
Stylidium verticillatum F. Muell.	Pink Mountain Triggerplant	1a		20

Synaphea petiolaris R.Br.		1b		15
Taxandria floribunda (Turcz) J.R.Wheeler & N.G. Marchant		1a		20
Taxandria parviceps Schauer.		1a		5
Tetraria capillaris (F.Muell.) J.M. Black	Hair Sedge	1a		20
Tetraria octandra (Nees) Kuk.		1a		12
Thysanotus dichotomus (Labill.) R.Br.	Branching Fringed Lily	1b		15
Thysanotus tenellus Endl.		1b		16
Trichocline spathulata (DC) J.H. Wills	Native Gerbera	1b		12, 15
Tricoryne elatior R. Br.	Yellow Autumn Lily	1b		16
Utricularia multifida R.Br.		1a		20
Verticordia habrantha Schauer	Hidden Featherflower	1a		20
Xanthosia atkinsoniana F. Muell.		1b		12, 15
Xanthosia candida (Benth.) Steud.		1b		12, 15
Xanthosia huegelii (Benth.) Steud.		1b		16
Xanthosia rotundifolia D.C.	Southern Cross	1a		20

Appendix 2 Western Australian Natives Susceptible to *Phytophthora cinnamomi.*

Compiled by E. Groves, G. Hardy & J. McComb, Murdoch University

***Information used to determine susceptibility to* P. cinnamomi**: *1a- field observations, 1b- field observation and recovery of* P.cinnamomi. *2a- glasshouse inoculation of* P. cinnamomi *and recovery, 2b- field inoculation with* P. cinnamomi *and recovery. NP- no information was given in the reference .*

PLANT SPECIES	COMMON NAME	ASSESMENT	RARE SPECIES (R)	NURSERY AVALABILITY (A)	REFERENCES
Acacia campylophylla Benth.		1b			15
Acacia myrtifolia (Sm) wild.		1b		A	9
Acacia stenoptera Maslin.	Narrow Winged Wattle	1b			16
Actinostrobus pyramidalis Miq.	Swamp Cypress	2a			17
Adenanthos barbiger Lindl.		1a		A	1, 13, 16
Adenanthos cumminghamii Meisn.	Albany Woolly Bush	NP		A	4, 8
Adenanthos cuneatus Labill.	Coastal Jugflower	1a		A	1, 6
Adenanthos cygnorum Diels.	Common Woolly Bush	1a			1, 7
Adenanthos detmoldii F. Muell.	Scott River Jugflower	1a			1
Adenanthos dobagii E.C. Nelson	Fitzgerald Jugflower	NP	R		4,8
Adenanthos ellipticus A.S. George	Oval Leafed Adenanthos	NP			8
Adenanthos filifolius Benth.		1a			19
Adenanthos ileticos E.C. George	Club Leafed Adenanthos	NP			8
Adenanthos meisneri Lehm.		1a		A	1
Adenanthos obovatus Labill.	Basket Flower	1b		A	1, 7 14,16
Adenanthos oreophilus E.C. Nelson		1a			19
Adenanthos pungens ssp. *effussus*	Spiky Adenanthos	NP	R		4
Adenanthos pungens ssp. *pungens*		NP	R		4
Adenanthos sericeus Labill.	Woolly Bush	1a		A	1
Agonis linearifolia (D.C.) Sweet	Swamp Peppermint	1b			6
Agrostocrinum scabrum (R. Br) Baill.	Bluegrass	1a			12
Allocasuarina fraseriana (Miq) L.A.S. Johnson	Sheoak	1b		A	1, 6, 14
Allocasuarina humilis (Otto & F. Dietr.) L.A.S. Johnson	Dwarf Sheoak	1a		A	1, 7 14
Allocasuraina thuyoides (Miq.) L.A.S. Johnson	Horned Sheoak	1a			19
Andersonia axilliflora (Stschegl) Druce	Giant Andersonia	NP	R		4
Andersonia caerulea R. Br.	Foxtails	1a			1, 6
Andersonia heterophylla Sond.		2b			1, 7
Andersonia lehmanniana Sond.		1a			1, 7
Andersonia pinaster Lemson.		1a	R		20

Andersonia simplex (Stschegl.) Druce	Spiked Andersonia	1b			6
Aotus ericoides (Vent.) G. Don		1a			7, 14, 17
Aotus passerinoides Meisn.		1a			14, 17
Astroloma cilatum (Lindl.)Druce	Candle Cranberry	1b			3
Astroloma xerophyllum (D.C.) Sond.		2b			1, 7, 19
Banksia aculeata A.S George		1a			20
Banksia ashbyi Baker .	Ashby's Banksia	1b, 2a		A	2
Banksia attenuata R.Br	Slender Banksia	1b, 2b		A	1, 11, 14, 16
Banksia audax C.A. Gardner		2a			11
Banksia baueri R.Br	Woolly Banksia	1b, 2a		A	1, 2, 11
Banksia baxteri R.Br	Baxter's Banksia	1b		A	1, 2, 11
Banksia brownii R.Br	Feather leaved Banksia	2a	R		4, 2, 8, 11
Banksia burdettii Baker f.	Burdett's Banksia	2a		A	2, 11
Banksia calyei R.Br.	Cayley's Banksia	2a		A	2, 11
Banksia candolleana Meisn.	Propeller Banksia	2a			2, 11
Banksia coccinea R.Br.	Scarlet Banksia	2a		A	1, 2, 11
Banksia cuneata A.S. George	Quairading Banksia	2a	R		8, 11
Banksia dryandroides Sweet	Dryandra-leaved Banksia	2a			11
Banksia elderiana F. Muell. & Tate	Swordfish Banksia	2a			11
Banksia gardneri A.S. George		2a			11
Banksia gardneri var brevidentata A.S. George		1a			20
Banksia gardneri var gardneri A.S. George		1a			20
Banksia goodii R.Br	Good's Banksia	NP	R		4, 8
Banksia grandis Willd.	Bull Banksia	2a		A	1, 2, 11, 14, 15
Banksia hookeriana Meisn.	Hooker's Banskia	2a		A	2, 11
Banksia ilcifolia R.Br.	Holly-leaved Banksia	1b			1, 14, 16
Banksia laevigata Meisn.	Tennisball Banksia	2a			11
Banksia laricina C.A. Gardner	Rose Banksia	2a			2, 11
Banksia lemanniana Meisn.	Lemann's Banksia	2a		A	11
Banksia lindleyana Meisn.	Porcupine Banksia	2a			2, 11
Banksia littoralis R.Br.	Swamp Banksia	2a		A	1, 11, 14
Banksia luffitzi C.A. Gardner		2a			11
Banksia media R.Br.	Southern Plains Banksia	2a		A	1, 11
Banksia menziesii R.Br.	Firewood Banskia	1b, 2a		A	1, 2, 11, 14, 16
Banksia micrantha A.S George		1a			20
Banksia nutans R.Br.	Nodding Banksia	1a, 2a			1, 2, 11
Banksia occidentalis R.Br.	Red Swamp Banksia	1a, 2a		A	1, 2, 11, 20
Banksia oligantha A.S. George	Wagin Banksia	NP	R		4, 8
Banksia oreophila A.S George	Mountain Banksia	1a			20
Banksia petiolaris F. Muell.		2b		A	11
Banksia pilostylis C.A. Gardner		2b		A	11

Banksia praemorsa Andrews	Cut-leaf Banksia	2a		A	1, 11
Banksia prionotes Lindl.	Acorn Banksia	1b, 2a		A	1, 2, 11
Banksia pulchella R.Br.		2a			11
Banksia quercifolia R.Br.	Oak-leafed banksia	1a			1, 6
Banksia repens Labill.	Creeping Banksia	2b		A	11
Banksia seminuda (A.S. George) Rye	River Banksia	1a		A	1
Banksia speciosa R.Br.	Showy Banksia	1b, 2a		A	1, 2, 11
Banksia sphaerocarpa R.Br.	Round- fruit Banksia	1b, 2a			1, 2, 11
Banksia telmatiaea A.S. George	Swamp fox Banksia	2b			1, 7
Banksia tricuspis Meisn.	Pine Banksia	NP			8
Banksia verticillata R.Br.	Albany Banksia	2a	R		8, 11
Banksia victoriae Meisn.	Woolly Orange Banksia	2b		A	11
Beaufortia anisandra Schauer		1b			6
Beaufortia micrantha Schauer	Little Bottlebrush	1a		A	20
Boronia fastigiata Bartl.	Bushy Boronia	2a			13
Boronia revolute Paul G. Wilson	Ironcaps Boronia	NP	R		4
Bossiaea eriocarpa Benth.	Common Brown Pea	1b		A	6, 16
Bossiaea ornata (Lindl.) Benth.	Broad leaf Brown Pea	1b			1, 3
Brachysema papilio Crisp.		NP	R		4
Calothamnus villosus R.Br.		1a			7
Chamelaucium erythrochlora N.G. Marchant & Keighery		NP	R		8
Chamelaucium griffinii N.G. Marchant & Keighery		NP	R		8
Chamelaucium roycei N.G. Marchant & Keighery		NP	R		8
Conospermum stoechadis Endl.	Common Smokebush	1a		A	1, 7
Conospermum todii F.Muell.	Victorian Desert Smokebush	NP			8
Conospermum triplinervium R.Br.	Tree Smokebush	2b		A	7
Conostephium pendulum Benth.	Pearl flower	1b			1, 16
Crowea angustifolia Sm.	Crowea	NP			1
Dampiera alata Lindl.	Winged-stem Dampiera	1a			7
Darwinia collina C.A. Gardner	Yellow Mountain Bell	NP	R	A	4, 8
Darwinia macrostegia (Turcz) Benth.	Mondorup Bell	NP	R	A	4
Darwinia meeboldii C.A. Gardner	Cranbrook Bell	NP	R		4, 8
Darwinia oxylepis N.G. Marchant & Keighery	Gillam's Bell	1a	R	A	1, 8
Darwinia squarrosa (Turcz) Domin.	Pink Mountain Bell	1a	R		1, 9
Darwinia wittwerorum N.G. Marchant & Keighery		1a	R		1, 11
Dasypogon bromeliifolius R.Br.	Pineapple Bush	1b			1, 7, 16
Daviesia decurrens Meisn.	Prickly Bitter-Pea	1b		A	15, 13
Daviesia incrassata Sm.		1a			7

Daviesia inflata Crisp.		1a			19
Daviesia megacalyx Crisp.		NP	R		4
Daviesia physodes G. Don.		NP			19
Daviesia preissii Meisn.					
Daviesia pseudaphylla Crisp.		NP	R		4
Daviesia rhombifolia Meisn.		1b			15
Dianella revoluta R.Br.	Blueberry Lily	1b		A	15
Dryandra falcata R.Br.	Prickly Dryandra	1a			20
Dryandra plumosa R.Br.		1a			20
Dryandra pteridifolia R.Br.	Tangled Honeypot	1a			20
Dryandra anatona A.S. George		NP	R		4
Dryandra arctotidis R.Br.		1a			1, 20
Dryandra armata R.Br.	Prickly Dryandra	1a			1
Dryandra bipinnatifida R. Br.		1a			1
Dryandra cirsioides Meisn.		1a			20
Dryandra formosa R.Br.	Showy Dryandra	1b		A	1, 6
Dryandra ionthocarpa A.S. George		1a	R		20
Dryandra lindleyana Mesin.		1a		A	1
Dryandra mimica A.S. George	Summer Honeypot	NP			8
Dryandra montana A.S. George		NP	R		4
Dryandra mucronulata R.Br.	Swordfish Dryandra	1a			20
Dryandra nivea (Labill.) R.Br.	Couch Honeypot	1a			1, 7, 14
Dryandra pteridifolia R.Br.	Tangled Honepot	1a			1
Dryandra plumosa R.Br.		1a			20
Dryandra quercifolia Meisn.	Oakleafed Dryandra	1a			20
Dryandra seneciifolia R.Br.		1a			1
Dryandra serra R.Br.	Serrate-leaved Dryandra	1a			1
Dryandra serratuloides Meisn.		NP			4, 8
Dryandra serratuloides Meisn. ssp. *Perissa* A.S George		NP	R		4, 11
Dryandra sessilis (Knight) Domin.	Parrot Bush	1a		A	1, 13
Dryandra squarrosa R.Br.	Pringle	1a			1
Dryandra squarrosa R. Br. ssp. *argillacea* A.S. George		NP	R		4
Dryandra tenuifolia R.Br.		1a			20
Eucalyptus marginata Sm.	Jarrah	2b		A	1, 14
Eucalyptus todtiana F. Muell.	Coastal Blackbutt	2a		A	7, 14
Evandra aristata R.Br		1a			1
Gompholobium polymorphum R. Br.		2a			13
Grevillea calliantha Makinson & Olde		NP	R		8
Grevillea cirsiifolia Meisn.	Varied-leaf Grevillea	NP			8
Grevillea crithmifolia R.Br.		1b		A	Shivas

Grevillea saccata Benth.	Pouched Grevillea	NP		A	8
Grevillea tripartita Meisn.		1a			20
Hakea ambigua Meisn.		1a			20
Hakea baxteri R. Br	Fan Hakea	1a			1
Hakea cucullata R. Br.	Hood leaved Hakea	1a			1
Hakea flabellifolia Meisn.	Fan-leaved Hakea	NP			19
Hakea lehmanniana Meisn.	Blue Hakea	1a			20
Hakea marginata R.Br.		1a			20
Hakea oleifolia (Sm.) R. Br.		1a			1
Hakea pandanicarpa ssp. *crassifolia* (Meisn.) R.M. Baker		1a			1
Hakea pendanicarpa R.Br. ssp. *crassifolia* (Meisn.)R.M. Barker		1a			20
Hakea prostrata R. Br.	Harsh Hakea	1a		A	1
Hakea trifurcata (Sm.)R.Br	Two-leaf Hakea	1a		A	1
Hakea undulata R.Br.	Wavy-leafed Hakea	1a			1, 20
Hibbbertia acerosa (D.C.) Benth.	Needle leaved Guinea Flower	1b			3
Hibbertia amplexicaulis Steud.		1b			15, 13, 3
Hibbertia commutata Steud.		1a			13
Hibbertia desmophylla (Benth.) F. Muell.		1b			6
Hibbertia furfuracea (D.C.) Benth.		NP			19
Hibbertia huegelli (Endl.) F. Muell.		2a			13
Hibbertia hypercoides (DC) Benth.		1b		A	1, 7, 16
Hibbertia inconspicua Steud.		1a			1
Hibbertia lineata Steud.		1b			15
Hibbertia montana Steud.		1b			3, 15
Hibbertia montana var *major* Steud.		1b			3
Hibbertia quadricolor Domin.		1b			13, 15
Hibbertia rhadinopoda Domin.		2a			12
Hibbertia stellaris Endl.		1b		A	13
Hovea elliptica (Sm.) D.C..	Tree Hovea	1b		A	17
Hovea pungens Benth.	Devil's Pins	2a			14
Hybanthus floribundus (Lindl.) F. Muell.		2a			12
Hypocalymma robustum (Endl.) Lindl.	Swan River Myrtle	1b		A	1, 7, 15
Hypocalymma strictum Schauer		1a		A	20
Isopogon attenuatus R. Br.		2b			17
Isopogon axillaris R. Br.		1a			1
Isopogon baxteri R.Br.	Stirling Range Coneflower	1a			20
Isopogon buxifolius R.Br. var *obovatus* Benth.		1a			20
Isopogon formosus R. Br.	Rose Coneflower	1b		A	1
Isopogon sphaerocephalus Lindl.	Drumstick Isopogon	1b			1, 3, 15

Isopogon teretifolius R.Br. *var petrophil.*(R.Br) D. Foreman		1a			20
Isopogon trilobus R.Br.	Barrel Coneflower	1a			20
Isopogon uncinatus R. Br.		NP	R		4, 8
Jacksonia floribunda Endl.	Holly Pea	1a			1, 7, 17
Jacksonia furcellata (Bonpl.) D.C.		1b		A	16
Jacksonia horrida D.C.		1a			1
Jacksonia spinosa (Labill.) R. Br.		1b			6
Jacksonia sternbergiana Huegl.	Stinkwood	1b			16
Kunzea ericifolia (Sm). Heynh.	Spearwood	1b		A	16
Kunzea sulphurea Torey & P. Morris		1a			1
Labichea punctata Benth.	Lance-leaved Bassia	1a			12
Lambertia ericifolia R.Br.	Heath-leaved Honeysuckle	1a			20
Lambertia echinata ssp. *echinate* R. Br.		1a	R		4, 1, 8
Lambertia echinata ssp. *occidentalis* Keighery		NP	R		4
Lambertia fairallii Keighery	Fairall's Honeysuckle	NP	R		4, 8
Lambertia inermis R.Br.	Chittick	1a			19
Lambertia multiflora Lindl.	Many-Flowered Honeysuckle	NP			19
Lambertia orbifolia CA Gardner	Round-leaved Honeysuckle	NP	R		4, 8
Lambertia uniflora R.Br.		1a			20
Lasiopetalum floribundum Beneth.	Free Flowering Lasiopetalum	1b			3, 14, 15
Latrobea genistoides (Meisn.)Meisn.		1b			6
Latrobea hirtella (Turcz) Benth.		1b			6
Leucopogon australis R. Br.	Spiked Beard-Heath	1a			1, 7, 14
Leucopogon capitellatus D.C.		1b			1, 3, 7, 13, 15
Leucopogon concinnus Benth.		1a			1
Leucopogon conostephioides D.C.		1b			1, 16
Leucopogon cymbiformis D.C.		1a			20
Leucopogon distans R.Br.		1a			20
Leucopogon distans R.Br. ssp. *contractus* (Benth) J.M. Powell		1a			20
Leucopogon elegens Sond.		1b			6
Leucopogon flavescens Sond.		1a			1, 6
Leucopogon gibbosus Stschegl		1a			20
Leucopogon gracillimus D.C.		1a			1
Leucopogon nutans E. Pritzel.		1b			1, 15, 13
Leucopogon obtectus Benth.	Hidden Beard-Heath	NP	R		8
Leucopogon oxycedrus Sond.		1b			3
Leucopogon parviflorus Sond.		1a			1
Leucopogon polymorphus Sond.		2b			7, 14

Leucopogon propinquus R. Br.		1b			1, 3, 7, 15
Leucopogon pulchellus Sond.		2b			17
Leucopogon revolutus R. Br.		1a			1
Leucopogon verticillatus R. Br.		1b			1, 3, 15
Lomandra odora (Endl.) Ewart.	Tiered Matrush	1a			1
Lomandra sonderi (F. Muell.) Ewart.		1b			1, 3, 13, 13
Loxocaryx cinerea R. Br.		1a			13
Lysinema conspicuum R. Br.		1a			20
Lysinema cillatum R. Br.	Curry Flower	2b			7
Macrozamia riedlei (Gaudich) CA Gardner	Zamia	1b		A	1, 14, 16
Melaleuca scabra R. Br.	Rough Honeymyrtle	2b		A	1, 7
Melaleuca subfalcata Turcz.		1a			20
Melaleuca thymoides Labill.		1b		A	16
Monotoca tamariscina F. Muell.		1a			1
Nemcia pulchella (Turcz) Crisp.		1a			1
Opercularia vaginata Juss.	Dogweed	1a			13
Patersonia babianoides Benth.		1a			13
Patersonia rudis Endl.	Hairy Flag	1a			1
Patersonia umbrosa Endl.	Yellow Flags	1a			1
Pattersonia occidentalis R. Br.	Purple Flags	1b		A	1, 7, 14, 15
Pericalymma ellipticum (Endl.) Schauer	Swamp Teatree	2a		A	7, 14
Persoonia elliptica R. Br.	Spreeding Snottygobble	1a			1
Persoonia longifolia R. Br.	Snottygobble	1b			1, 13, 14, 17
Petrophile biloba R. Br.	Granite Petrophile	2a			14
Petrophile divaricata R.Br.		1a			20
Petrophile diversifolia R. Br.		1a			1
Petrophile drummondii Meisn.		1a			7
Petrophile ericifolia R.Br.		1a			20
Petrophile linearis R. Br.	Pixie Mops	1b			1, 7, 16
Petrophile longifolia R.Br.	Long Leaved Conebush	1a			20
Petrophile media R.Br.		1a			20
Petrophile seminuda Lindl.		1a			20
Petrophile serruriae R. Br.		1a			1
Petrophile squamata R.Br.		1a			1
Petrophile stricta Foreman		1a			7
Pimelea suaveolens Meisn.	Scented Banjine	1b			13, 15
Platysace compressa (Labill.) Norman	Tapeworn Plant	1a			13, 17
Podocarpus drouynianus F. Muell.	Wild Plum	1b		A	1, 14
Scaevola calliptera Benth.	Grey Scaevola	2a		A	12
Scholtzia involucrata (Endl.) Druce.	Spiked Scholtzia	1a			1

Sphenotoma dracophylloides Sond.		1a			20
Sphenotoma gracile (R.Br.)Sweet	Swamp Paper-heath	1a			20
Sphenotoma squarrosum (Benth.) F. Muell.		2a			14
Stirlingia latifolia (R. Br.) Steud.	Blueboy	1a			1
Stirlingia tenuifolia (R.Br.) Steud.		1a			20
Stylidium amoenum R. Br.	Lovely Triggerplant	2a			12
Stylidium junceum R. Br.	Reed Triggerplant	2a			12
Stylidium schoenoides D.C.	Cow Kicks	1a			12
Stylidium spathulatum R. Br.	Creamy Triggerplant	1b			6
Styphelia tenuiflora Lindl.	Common Pinheath	1b			1, 13, 15
Synaphea petiolaris R. Br.	Synaphea	1a			1
Synaphea polymorpha R.Br.	Albany Synaphea	1a			20
Tetrarrhena laevis R. Br.	Forest Ricegrass	1a			13
Tetratheca hirsuta Lindl.	Blackeyed Susan	2b			12
Tetratheca pilosa Labill.		1b			9
Tetratheca setigera Endl.		1a			20
Thomasia grandifolia Lindl.	Large Flowered Thomasia	2b			7
Thyrptomene saxicola (Hook) Schauer	Rock Thryptomene	1a			7
Thysanotus thyrsoideus Baker		1a			13
Tremandra stelligera D.C.		1a			1
Trymalium ledifolium Fenzl.		1b			3, 14
Verticordia densifolia Lindl.	Compacted Featherflower	1b		A	4, 7, 14
Verticordia huegelii Endl.	Varigated Featherflower	2b		A	7, 14
Verticordia nitens (Lindl.)Endl.	Morrison Featherflower	1a		A	1, 7
Xanthorrhoea nana D.A. Herb	Dwarf Grasstree	1a			1
Xanthorrhoea brevistyla D.A. Herb		1a			20
Xanthorrhoea drummondii Harv.		1a			1
Xanthorrhoea gracilis Endl.	Graceful Grasstree	1b			1, 3, 7, 13, 14, 15
Xanthorrhoea platyphylla D.J. Bedford		1a			20
Xanthorrhoea preissii Endl.	Grasstree	1b		A	1, 3, 7, 13, 14, 16
Xylomelum angustifolium Kippist & Meisn.	Sandplain Woody Pear	1a			1
Xylomelum occidentalis R. Br.	Woody Pear	1a			1, 7

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