



Associations of Societies for
Growing Australian Plants

Rainforest Study Group

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Angiopteris evecta (Marattiaceae)

Giant Fern or King Fern, the only known
surviving NSW individual.

The King Fern is native to Madagascar through to tropical Asia, the western Pacific and extending into NE Australia. The occurrence of this fern in NSW is a relict of a once wetter climate. The species was thought to have been extinct in NSW however in 1978 a single individual was found in the eastern ranges of the Tweed Valley. The Sydney Herbarium possesses a specimen of *A. evecta* allegedly collected from the Tweed Valley in 1909. Additional reports exist today of specimens occurring in the Mc

Pherson Ranges, Brunswick Heads and the surrounds of Mt Warning however no authenticated records exist. This species was also found in the Broken Head, Byron Bay region, however were reportedly translocated for scientific research and botanical collections. Due to the species unique growth habit and preference of growing near to creeks it is unlikely that other individuals are to be found in the far northeast of NSW. Private landowners may also be cautious about disclosing the whereabouts of such a magnificent species to government agencies. The nearest recognized population to the Tweed Valley individual is in the Palmwoods, Diamond creek area in SE QLD, and additionally Frazer Island and Carnarvon Gorge. Within the Wet Tropics of North Queensland this species commonly occurs along roads and wet soaks in disturbed areas. Outside of the WT area, less than 50 plants exist. Personally the specimen in NSW is phenotypically different to those in NE QLD possessing leaves with a more sclerophyll-like nature; genetic analysis may possibly disclose clues to this ferns inheritance and possible genetic divergence. The NSW specimen co-occurs with *Macadamia tetraphylla*, *Hicksbeachia pinnatifolia*, *Alphitonia excelsa*, *Quintinia verdonii*, *Hedraianthera porphyropetala* and (of course) *Cinnamomum camphora* in disturbed metamorphic CNVF.

Fossilized fronds of 'Angiopteris-like' ferns date back to the Mesozoic era some 200 million years ago and have been found in Tasmania. This highlights the great change in Australia's vegetation over millennia. Within North QLD this species occurs up to at least 600m altitude and over its entire range requires constant moisture. When water stressed, the turgor pressure within the fronds lessen and the leaves becoming horizontal.

Within the garden this species requires constant moisture to enable its giant leaves to remain erect and collect light. I have tried growing this species and have lost at least six individuals, currently I have three plants surviving in a very wet gully situation in full shade with their roots able to access permanent running water. It is tolerant of cool conditions with some noteworthy specimens existing in the Sydney Botanic Gardens. Propagation is either by spore, tissue culture or by removing the lobes from the trunk and striking them in a moist medium. The NSW specimen has proved unsuccessful at propagation.

More information can be found at:

http://www.nationalparks.nsw.gov.au/PDFs/approved_angevect.pdf



Davidsonia jerseyana, (syn. *D. pruriens* var. *jerseyana*) Cunoniaceae, (syn. Davidsoniaceae) with Mt Warning, 1157m

A most familiar species to horticulturists involved in rainforest plants *D. jerseyana* has been awarded a space in almost every arboretum and rainforest planting within the subtropics. It naturally occurs only in the Brunswick and Tweed Valley's in far north-eastern NSW below 300m altitude in Complex Notophyll vine thickets, wet sclerophyll forests and within *Cinnamomum camphora* regrowth. The species is classified as Endangered under the Threatened Species Act 1995 (TSC Act) and additionally under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). In regions this species occurs in Lowland Subtropical Rainforest on Floodplains which is listed as an Endangered Ecological Community under the TSC Act.

Persisting natural populations are threatened by damaging land use practices, weed invasion, excessive environmental exposure resulting in poor seedling recruitment, high rates of predation by native and exotic fauna, seed collectors, bushfood enthusiasts and road works. The photographed location was once a biodiversity rich ecosystem. Today all that remains are persistent individuals and meagre remnants in an otherwise barren landscape devoid of the once luxuriant rainforests of the Tweed Valley basin. These particular specimens, above, are very likely to have regrown following clearing of the rainforest. This assumption is due to their multiple stemmed habits arising from a single rootstock and the species inability to recruit in

such exposed conditions with persistent grazing. The landowner has lived on site for 60 years and says that the trees haven't changed much over that time. The trunks are noticeably glazed by cattle rubbing on them; this effectively removes the cauliflorous flower spikes, however the trees at this location bear heavy crops of fruit, each year, from further up the stem.

Within the garden *D. jerseyana* is best established in semi shaded conditions when young and tolerate full sun once established. The fruit and leaves are prone to sunburn if grown in exposed conditions with temperatures over 35°C resulting in the scalding of fruit on the exposed leafless trunks. Leaf yellowing can also occur in full sun. Pest of the fruit crop include Fruit fly, King Parrots and alike, Rodents and to a lesser extent Fruit Bats. The predators are largely seeking the kernel of the seeds and not the flesh. In NQld, Cockatoos can entirely predate a crop of fruit in search of the seeds of *D. pruriens*. No predation of *D. johnsonii* has been witnessed as this species produces a viable seed once in every billion fruit! There is genetic individuality with the phenotypes of *D. jerseyana*. The specimens occurring around Brunswick Heads possess leaves with a convex leaf margin and purplish new growth rather than pink, the fruit are also larger. It has been a goal of mine to collect material from all the wild sites and keep them in a field gene bank. I have already collected from over 35 sites however my current pursuits have effectively halted this project.

In an Orchard situation this species can be planted as close as 1m apart. I planted a couple of hundred trees at 30cm intervals and think that this is a desirable spacing if additional water is supplied. A row spacing of 2 m is ideal depending on access requirements. The cauliflorous growth habit lends well with orchard management. Trials indicate a positive correlation between light reaching the trunks and increased formation of floral protuberances; this has increased flower production in my orchard. To combat against sun exposure I have used a cover of *Alphitonia petriei* especially whilst the orchard was establishing. I regularly pruned the lower branches of *A. petriei* to force them into vertical growth rather than expending their energy into branches. This has created an umbrella effect to the orchard.

My grandmother has *D. jerseyana* growing in Melbourne however no fruit has been set. Potted plants of this species are especially prone to twisted roots and thus poor growth. Freshly sown seeds are favoured by rodents and most fruits produce one fertile and one infertile seed.

More information can be found at:

http://www.nationalparks.nsw.gov.au/PDFs/recoveryplan_draft_davidsonia_jerseyana.pdf



The ASGAP Rainforest Study Group members visiting Peter Bevan's arboretum. Left to right: Wendy Clank-Hackett, Craig Sollitt, Peter Bevan (Host), Heather Knowles, Martin Bennett, Jan Sked (ASGAP Co-ordinator), Kris Kupsch. My father, Robert Kupsch took this photo!

The Rainforest Study Group held at Lowood on the 27th of June was a very informative event. Local plant enthusiasts from the Ipswich region and Lockyer Valley combined with Jan and Craig travelling from north of Brisbane, allowed for diverse discussions on rainforest species. I was most impressed by Peter's collection of tropical rainforest species which were performing well under the much drier conditions of Lowood. Peter's planting really illustrates how hardy some of the megathermal rainforest species are. Many thanks go to Peter and his family for hosting this event and providing a much welcome lunch!



Owenia venosa (Meliaceae)

Peter Bevan's Garden, Lowood, June 2004.

The Rose Almond obtains a height of 20m in dry microphyll rainforest often in association with *Araucaria cunninghamii* and sclerophyll forests from the dry tropics near Marlborough in CE QLD to the NSW border at Mount Lindsey in NE NSW. The fruit in this picture are slightly immature. They are red at maturity and 2-4cm across with 2 or 4 embryos per fruit. The seeds are notoriously difficult to germinate however Peter Bevan has had some success with its

propagation. The seeds take up to 1 year to begin germination (if at all) although the transplanting of root suckers has shown good success.

In the garden this species requires well drained soil in full sun. Additional applications of fertiliser may help to speed its otherwise slow growth rate. I recently planted my first two specimens in the arboretum deciding to place them where they won't become crowded from adjacent rainforest plants. In a high rainfall area (>1500mm) dry rainforest plants can become easily out competed by the more vigorous large leaved species and often succumb to fungus invasion during the wet season. Therefore the careful placement of these specimens in an arboretum is important; i.e. don't plant one right next to your *Ficus nodosa* or *Flindersia brayleyana*!

The family Meliaceae is typical of wet rainforests. The genus *Owenia* however has adapted towards the colonisation of marginal drier rainforest habitats. The Onion Cedar *Owenia cepiodora* is the sole occurring species in this genus which inhabits the wetter coastal rainforest of the Tweed-Lismore region. All the remaining species occur in drier rainforests and woodlands. I have only seen *O. venosa* in the wild on one occasion; this was near Bundaberg growing on kraznozem soil in association with *Cupaniopsis shirleyana*, *Flindersia collina* and *Ficus opposita*. The trees were bushy about 15m tall with great character, very appropriate for a park tree in a dry Queensland town.



Syzygium sp. aff. wilsonii (Myrtaceae)
 Photographed: Tawolla, near Topaz.
 July 2004.

The presence of this species was initially brought to my attention by a cultivated plant in Burringbar, NSW over 5 years ago. The horticulturalist called it *Syzygium sp. "Danbulla"*. I recently had the opportunity of visiting a population which was in full flower. This species occurs in the vicinity of Tinaroo Falls and the Topaz region on the Atherton Tableland. The plants resemble *S. wilsonii* however have pink flowers; the leaves have lesser pronounced venation and a stiffer habit. This undescribed species or subspecies, has huge horticultural potential due to its attractive flowers and dwarfed habit. In the wild it was found growing only on depauperate soils in a very high rainfall region. Associated species at Topaz were *Cyathea robertsiana*, *Acsmithia davidsonii*, *Austromathea elegans*, *Symplocos sp. Boonjee*, *Crispiloba disperma*, *Ceratopetalum virchowii*, *Syzygium sp. aff. alliligneum* and *Helmholtzia acorifolia*. In cultivation this species obtains a maximum height of three metres and possesses an upright bushy habit, however in the wild has a sprawling poorly formed habit. Botanist Lyn Craven is currently working on this species to determine its correct taxonomic status. This species highlight the significance of microhabitats within the larger expanse of 'rainforest' and the role they play in promoting speciation. Speciation may commonly develop in rainforests via 'sympatric speciation'. This is where species arise due to the myriad of niches within a rainforest habitat; new species evolve in association with their ancestors. This species may have developed via Parapatric speciation in which a variation in environment, such as soil type or aspect creates change in the colonising species; whilst the original species continues unchanged in the neighbouring habitat. This species occurs adjacent to well developed rainforest growing on deep basalt soil however was only found on the shallower poorer soils. The widespread *Syzygium wilsonii* spp. *wilsonii* can be found occurring within the district however isn't found growing on the poorer soils in association with this subspecies/species.



Cupaniopsis diploglottoides (Sapindaceae)
 Velvet Tuckeroo or Daintree Tuckeroo

Until recently this species was simply known as *Cupaniopsis sp. Daintree*. It possesses leaves which are more characteristic of a *Diploglottis* than that of *Cupaniopsis*. It only grows in very-wet complex mesophyll rainforests below 300m on alluvial granite and less commonly on metamorphic soils between the township of the Daintree and the Bloomfield River. In the wild this species often occurs as a single stemmed understorey tree to 4 metres with a couple of 1m long compound leaves positioned at the top. The Qld herbarium has no meaningful classification for the species; it should be recognized as rare. Colleagues and I rarely encounter the species in the field, I know of only 5 plants. In the garden this species has preformed remarkably well. The tree photographed is 8 years old, 5m tall and has now flowered twice. The new growth is maroon colour and very striking. I suggest a semi shaded position in the garden with additional watering whilst establishing however seems accepting to much lower rainfall and cooler conditions. Propagation material of this species is scant and garden specimens exist largely from the initial seed collection from the wild in the early 1990's. Further material is likely to arise as further cultivated plants mature. There are two fine specimens in the Flecker Botanic Gardens, Cairns. The *Cupaniopsis* genus contains some of Australia's most attractive garden species. Disregarding my bias towards tropical plants this species is certainly my favourite before *C. newmanii* from the Border Ranges, *C. dallachyii* from NQLD and *C. wadsworthii* from SE QLD.



Syzygium cormiflorum (Myrtaceae) Bumpy Satinash, Topaz, 650m alt. 4500mm annually, kraznozcm soil. July 2004

The Bumpy Satinash is a common species in the tropical rainforests of North-eastern Queensland. There are two forms, one being ramiflorous and this one being cauliflorous. The cauliflorous variety is more common at higher altitudes and the ramiflorous form occurring more often in the seasonal lowlands, being especially common around Cairns on metamorphic substrates.

In the garden this species takes about 8 years to flower at a trunk diameter of 10cm and a height of 4 metres. The cauliflorous form is far more attractive as a garden piece however within a nursery they both look identical. They tolerate full sun when young and quickly adopt a bushy habit. The cauliflorous form should be better utilised as a park tree for its unusual morphology alone. The ramiflorous form is more tolerant of drier seasonal areas whilst the cauliflorous form tends to be suited to wetter areas ($\geq 1500\text{mm}$).

The cauliflorous nature of producing inflorescences from the trunk is likely to have arisen as a method of pollination or seed dispersion. An adaptative strategy within a dense rainforest environment may be to present flowers or fruits in the best possible manner so as to be contrasting from the surrounding vegetation. Many species produce brightly coloured fruits that are noticeable to seed dispersers. This species may also be employing a strategy to cater for the long extinct megafauna which could have utilised the fruit as a food source directly from the trunk.



Callerya pilipes (syn. *Milletia pilipes*) (Fabaceae) photographed at Julatten, July 2004.

This twinning tropical vine is endemic to the Wet Tropics up to 800m altitude. It is found more commonly in the lowlands with most collections originating from the Daintree area, it should be considered a rare species. The furry compound leaves possess up to 10 leaves with a terminal leaflet. Recently the three described *Milletia* species have been transferred to the *Callerya* genus. The *Callerya* genus is distinguished from *Milletia* by having flower inflorescences (panicles) that are greatly ramified and also by having solitary flowers per panicle node, diadelphous stamens (where the stamens are bounded into two separate groups) and conspicuous bracts and bracteoles (Schot 1994).

There are an additional two species of *Callerya* remaining to be described in North Queensland, being *C. sp. Beatrice River* in the Palmerston area and *C. sp. Barrett's Creek* a tributary of the Daintree River.

In the subtropics *C. pilipes* is a moderate grower that requires ample light in order to flower well. It is best positioned on a trellis or bushy small tree so as to avoid it becoming lost among the leaves in the canopy.

C. australis and *C. pilipes* benefit from the seed coat being nicked with a scalpel to induce germination. *C. megasperma* and *C. sp. Beatrice River* don't require treatment. I'm unsure of the requirements of *C. sp. Barrett's Creek*.

Reference: Schot, A. (1994) A revision of *Callerya*. Endl (including *Padbruggea* and *Whitfordiodendron*) (Papilionaceae: Millettieae) *Blumea* 39: 1-40



Stenocarpus davallioides (Proteaceae) The “trunk” photographed at Mt Lewis, NQLD growing in complex notophyll vine forest at 1150m altitude, rainfall approx 4000mm.

This species is perhaps one of the best foliage plants in the world. The juvenile growth which lasts approximately five to ten years is finely tripinnate and resembles that of the fern genus *Davallia*. The Fern-leaf *Stenocarpus* is restricted to high altitude and high rainfall areas on granite between Mount Lewis and Thornton Peak in the Daintree area. Within the forest the species obtains large dimensions with a girth of 1m or more. Associated species are *Podocarpus smithii*, *Oraniopsis appendiculata*, *Acmena resa*, *Placospermum coriaceum*, *Romnaldia grillata*, *Polyosma rigidiuscula*, *Ardisia* sp. ‘South-Mary’, *Gossia lewisensis*, *Calamus australis*, *Sphalmium racemosum*, *Endiandra phaeocarpa*, *Catalepidia heyana* and *Aglaia brassii*.

In the garden it requires well drained soil and a full sun situation with good mulching and watering. I have found that they don’t do well in heavy clay soils and that basalt soils allow them to thrive. The adult foliage resembles that of *Stenocarpus salignus* and/or attains simple leaves. The flowers are similar to *S.salignus* being a white umbel consisting of about 12 flowers. Propagation is best via cuttings as cultivated trees often produce seedlings which aren’t true to type and these form the source of the cultivars *Stenocarpus* clt Forest Gem and *Stenocarpus* clt. Forest Lace which are grown for their foliage.

The *Stenocarpus* genus is one of many in the Proteaceae family. This genus is within the tribe *Embothrieae* which is shared by four sub tribes of which *Stenocarpus* is within the *Stenocarpiinae* containing *Stenocarpus* and *Strangea*. All species occur within rainforests however *Stenocarpus acacioides*, *S. angustifolius*, *S. verticis* and *S.cunninghamii* occur in monsoon rainforest and riparian areas in Australia’s tropical north. Additional species that are rarely cultivated are *S.cryptocarpus* and *S.reticulatus* which are endemic to the Wet Tropics. *Stenocarpus reticulatus* has small white/cream flowers and simple leaves to 50cm in length. It grows into a very large tree and occurs naturally from the lowlands to the highlands on granite alluvium and basalt. It is relatively hardy and tolerates full sun from an early age. *Stenocarpus cryptocarpus* is also hardy however its large leaves are easily damaged from low humidity and high temperatures. It is easily seen in the tropical rain forest when in flower. It apparently occurs in the highlands however I have never seen it growing about 500m altitude. Both the former two species could be grown in a protected location as far south as Sydney.

Kris’s helpful Hint 3:

It is best to water a rainforest garden by applying large amounts of water at widely spaced intervals than watering lightly and often. Regular light applications can encourage surface roots and increase the susceptibility of your garden to increased water stress during droughts. It is better to water once or twice in the dry season continuously for up to three days, so as to recharge the soil profile to a depth of at least 2 metres. This will encourage the root systems to search for moisture deeper within the soil. Also you can never beat a thick layer of organic mulch for moisture retention.



Oraniopsis appendiculata isolated after clearing of complex mesophyll rainforest at Tawolla, Topaz.



An unusual occurrence of *O. appendiculata* growing within gallery rainforests in the Lamb Range, QLD.

The monotypic genus *Oraniopsis* is endemic to the area just south of Tully to the Big Tableland near Cooktown. It is an abundant species in high rainfall rainforests at altitudes above 500m and less common along water courses in the lowlands. It typically occurs in the understorey of dense tropical rainforests often looking much like a Coconut, however I was recently amazed to find this species thriving in gallery forests associated with *Eucalyptus grandis* and dense infestations of *Lantana camara*. The above individual located within a cow paddock was a surprising find as this species naturally occurs in very shady conditions. In habitats of lower rainfall areas this species is restricted to creek lines, in the high rainfall mountainous areas such as Topaz it can be found away from creek lines. The genus *Oraniopsis* was once an *Orania*, a genus of palms that exist in SE Asia, the Philippines, Indonesia, Malaysia, PNG and Madagascar. The closest relatives *Ceroxylon* exist in the Andes of South America which suggest a Gondwanan link.

In the garden this species has performed extremely well with the sole requirement being constant water. I have several specimens in NE NSW all about 8 years old, the plants I have positioned on the edge of the creek have grown far better than those further away. Propagation is by seeds however they prove to be slow to germinate. I planted 700 fresh cleaned seeds and have 30 which have germinated after 1 year. They are notoriously slow growing with the above specimen, being possibly 100 years old. Specialist nurseries often stock this species from time to time.

FUTURE FIELD DAYS

There will be two field days held towards the end of this year. One will be in Yowie Bay, Sydney and another on the Sunshine Coast in QLD. I will advise in the next newsletter as to the details of these two events.

A question was raised as to the establishment of a seed-bank for the study group. I'm in favour of this however many rainforest species often have a short viability.

I instead suggest a registrar of persons who have computer access and are willing to trade in seeds. Every time a person has some seeds to trade they email the "super enthusiastic individual" - probably will be I! (who acts as the Central Processing Unit) and they send an email out to the study group members that have registered their interest in obtaining and trading seeds.

Another point I need to raise is that I'm very interested in hearing from members about their experiences in growing rainforest plants. Currently the articles have been forcefully extracted from my head so I would be very pleased to receive a few written, typed or emailed articles of interest. Notes on successful propagation techniques, ecological observations or just about anything you may think others would want to see in the newsletter would be nice.

I hope this newsletter has been informative and don't hesitate to contact me. Thanks again from Kris

Your collection of rainforest species could be a threat!

The translocation of native species between bioregions increases the potential introduction of a new invasive species into nearby local bushland. This is a list of species which I have encountered as having illustrated a significant level of adaptability in the form of seedling recruitment within my arboretum. Those marked with an asterisk are considered to be potential ecological transformers in which they may compete negatively with locally endemic species.

**Aleurites rockinghamiensis*- trees produce seeds in abundance; this species has the potential of certainly establishing itself in subtropical rain forested areas. It is fast growing and actively competes for light using its large leaves. Localised populations may exist within the following ten years. Marsupial dispersed.

Antidesma erostre- seedlings carpet the ground beneath shrubs however no individuals have been found away from parent stock. Probably bird dispersed.

**Archontophoenix alexandrae*-certainly of concern in wetter subtropical areas. Within the Tweed Shire this species is becoming common along riparian areas. It is identified from *A.cunninghamiana* by its silver underside to the leaf. It can grow much faster than Bangalow Palms and also hybridise. Bird dispersed.

**Blepharocarya involucrigera*-numerous seedlings have been produced from a single individual, this species tolerates shade and dry seasonal conditions. It should be monitored for further spread of plants. Wind dispersed.

Camarvonnia araliifolia var. *montana*- occasional specimens of this species exist. It may become a localised species surrounding arboretums in high rainfall areas unless care is taken. Wind dispersed.

**Cordia dichotoma*- This species is perhaps 'the one' that will be the first to go from my plantings. Several specimens are present in and around my arboretum. The species has the ability of recruiting in open paddock situations. Occurs naturally as south as Bundaberg. Bird dispersed.

Cryptocarya sclerophylla- native to south eastern Qld in dry scrubs this species is slightly spoilt in the Tweed Valley. Numerous seedlings exist within 20m of the parent stock. Bird dispersed.

Cupaniopsis cooperorum- approximately a dozen seedlings have grown from a single years fruiting. Naturally this species occurs in a restricted area of very high rainfall however thrives in the wet subtropics. Currently this species is of no concern however should be monitored for spread. Bird dispersed.

Darlingia darlingiana-Occasional seedlings occur of this species, it may become established in the warm moist basalt country around Alstonville and the Sunshine coast. Wind dispersed.

**Flindersia* spp.- *F.brayleyana* and *F.pimeteliana* have shown the ability of self recruiting. *F.brayleyana* is already a serious weed in other regions of the world. A single *F.brayleyana* tree has produced 30 seedlings in two years of fruiting. Wind dispersed.

Glochidion hylandii- a single individual has self recruited and this species requires moist cool mountainous conditions so I doubt that this species is of concern. Bird dispersed.

Harpullia ramiflora- very common recruit with 5 m of trees, occasional specimens 50m away. Native to tropical Asia and north of Iron Range CYP. Tolerates dry conditions. Bird dispersed

Homolanthus novoguineensis- an occasional recruit on fertile soil around some arboretums. Short lived and prefers basalt soils for best development. May become naturalised in volcanic derived high rainfall areas such as the Sunshine Coast or the former Big Scrub area in NSW. Bird dispersed.

**Mackinlaya macrosciada*- very happily recruiting under parent shrubs, occasional with 20m distance. Amazes me as to why it doesn't already occur in NE NSW as its southern limit is around Gympie. Grows very well and has huge potential of becoming established in disturbed subtropical rainforest. Bird dispersed.

**Mallotus* spp.-already finding their way into ecological surveys of local bushland, *M.mollissimus* and *M.paniculata* are native to QLD. *M.paniculata* endemic to the tropics and *M.mollissimus* as far south as Gympie. Both species have the ability of fruiting in two years and are very fast growing. They however don't tolerate shade, require disturbed habitats and are short lived. Bird dispersed.

Melicope rubra (syn. *Evodiella muelleri*)-Occasional seedlings, shrubs become sparse with age, poor competitors in low light conditions. Bird dispersed.

Phaleria clerodendron- seedlings carpet the ground beneath garden plants, produced massive crops of red seeds. Cold conditions may restrict its naturalisation in the subtropics. Unknown seed disperser in gardens.

Polyscias australiana- 1 seedling after 8 years. Very common pioneer species in the tropics. Maybe a sleeper weed which requires the timing of favourable environmental parameters for mass recruitment. Bird dispersed.

**Syzygium 'Cascade'* -I'm becoming concerned with this cultivar; parent trees produce huge amounts of seed and seedlings carpet the ground beneath. Vigorous grower in ideal conditions. Bird dispersed.