Parentless *Pittosporum turneri*

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INTRODUCTION

When I was first introduced to the Volcanic Plateau flora my tutors spoke of *Pittosporum turneri* in almost arcane tones. This attitude was probably a manifestation of large gaps in our knowledge of the species and that adult trees are unknown in the wild. While we understand some of the species' ecological details such as distribution, habitat, and habit of the divaricating juvenile shrubs we know little of its reproductive biology, life expectancy, and the architecture of adult trees. Certainly, many mysteries remain, but with continuing observation small components of the story are gradually unfolding and at a pace that suggests it is timely to undertake a brief review of the state of our knowledge.

DISTRIBUTION AND ABUNDANCE

Pittosporum turneri is a member of a declining list of central North Island endemics — in recent years several species considered to be endemic to central North Island have become disjunct species with their discovery in South Island — but it is highly unlikely *P. turneri* will relinquish this status. Eleven populations have been recorded in the past but only six are positively known today and all those consist of juvenile plants:

(1) Mangapehi near Pureora; near the road from Barryville to Bennydale.
(2) Whenuakura Clearing, eastern Hauhungaroa Range.
(3) Kuratau River catchment, southern Hauhungaroa Range.
(4) Ripia Stream headwaters on Lochinver Station, northern Ahimanawa Range.
(5) Lake Otamangakau, Rotoaira basin.
(6) Kapoors Road, Tongariro State forest, south of Mt Taurewa.
(7) Erua State Forest Sanctuary, west of Hauhangatahi.
(8) Southern Mangaohane Plateau, north-west Ruahine Range.

Two other possible, though vague, locations are recorded from imprecise accounts on herbarium sheets from Rangataua and from the Rangitoto Range near Te Kuiti (NZFRI).

According to A P Druce (pers. comm.) the Pureora population (Figs 1, 2, and 3) occupied riparian Taupo Pumice terraces above the Waimihia River. Tragically, this most northerly population was destroyed by farm development.

Further south on the eastern margin of Hauhungaroa Range is an attenuated forest clearing, the Whenuakura Clearing, bordering Whanganui Stream. Typical Volcanic Plateau 'frost-flat' vegetation dominates, that is, red tussock, monoao, and scattered *Olearia virgata*. Various mixes of podocarps and hardwoods, some partly logged, envelop the clearing with the transition zone species, silver pine, mountain toatoa, and bog pine common on unfired margins. Although a fire has killed a large number of juvenile and sub-mature *Pittosporum turneri* shrubs on the southern margin of the clearing, some 200 saplings and seedlings grow in the transition zone of the northern margin. Many saplings are up to 6 m tall but no adults are evident.

The Kuratau population(s) occurs also on the eastern slopes of the Hauhungaroa Range. There are no recent records of this population but

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Fig. 1. The densely divaricating habit and columnar form of *Pittosporum turneri* saplings on a forest margin at Pureora. This population occupied riparian terrace of Taupo Pumice flanking Waimihia Stream but was destroyed by vegetation clearance. Photo: A P Druce

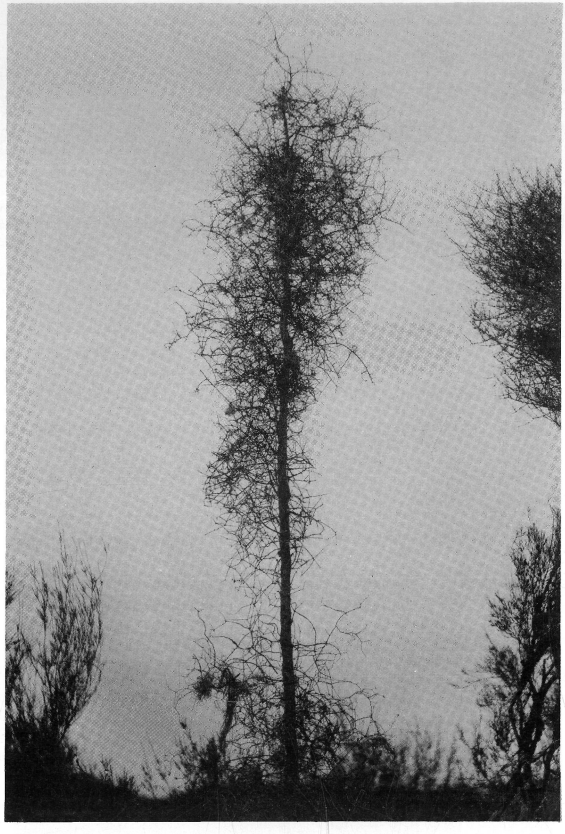

Fig. 2:
Whorls of branches radiate from nodes throughout the trunk of this sapling.
Photo: A P Druce

Fig. 3:
Adult foliage and seed capsules from a plant originally at Pureora. Photo: A P Druce

anecdotal accounts and herbarium records refer to a series of riparian sites at Kuratau Stream, about a clearing adjoining the Turangi-Whakamaru highway. The substrate here is Taupo Pumice overlying older welded ignimbrites. In the past, roadworks associated with bridge construction probably destroyed 2 adult trees previously known to A P Druce (pers. comm.), but other individuals may remain within open vegetation either side of the bridge. J K Bartlett reported a population from Otaratiri Stream in the headwaters of Kuratau Stream.

Across to the east on Lochinver Station in the northern foothills of Ahimanawa Range, the only eastern Volcanic Plateau population occurs. Two adjacent headwater gullies feeding the upper Ripia River, east of Tihorea, support *Pittosporum turneri* amongst scrub and low forest. The gullies are etched in deep Taupo Pumice terrace deposits on lower hill-slopes flanking the wide pumice infilled basins of the Ripia River headwaters. Undoubtedly, the populations mark the original transition zone where forest above gave way to scrub and tussock in basins below. In more detail, uppermost beech forest gives way to a forest of mixed hardwood species in turn above silver pine, mountain toatoa, *Myrsine divaricata* and *Coprosma propinqua* (with *P. turneri*) and below a monoao shrubland with abundant *Hebe* sp. (*Veronica arborea*) (see Druce 1987 for more detail). A cohort group of some 50 *P. turneri* occupies one gully and scattered saplings the other, and all are devoid of adult foliage (see illustration Eagle 1975). It is not difficult to imagine that *P. turneri* was more widespread in this catchment on the inverted treelines within wide basins of the Ripia headwaters before the onset of farming.

In spite of the hydro-electric alteration of the Rotoaira basin at the northern foot of Mt Tongariro, a further population survives on the northern shores of Lake Otamangakau west of Kakaramea. Some amenity planting nearby has not threatened the stand. Although this population is associated with the Wanganui River headwaters, it is little distance from the Kuratau Stream catchment population.

A population recently uncovered in a pumice-infilled basin in Tongariro State Forest, shows again that *Pittosporum turneri* is a species predominantly of forest margins. Here approximately 50 tall saplings grow along forest margins and in basin shrublands of mountain inaka, bog pine, red tussock and mountain toatoa. With further searching one can uncover numerous seedlings in the understorey of open silver pine-mountain toatoa forest about the clearing, particularly along stream margins. Insufficient understorey light levels will ultimately lead to the demise of these seedlings. The tall saplings of the clearing grow mostly on well drained, though intensely frosty, pumice substrates and not in the upper reaches of the clearing where on poor drainage sites, monoao replaces mountain inaka. Such open vegetation in the basin is both a product of edaphically wet conditions and cold-air inversion.

Perhaps the best known population occurs in the eastern margin of Waimarino Plateau at Erua. A recent survey of the Erua sanctuary and environs (Ecroyd 1981) noted several hundred seedlings beneath a very open *Pinus ponderosa,* plantation outside the reserve (Fig. 4). The reserve contains an impoverished population of saplings and seedlings with many dead saplings and others with debilitated or dead upper sections. Several individuals grow with silver pine and mountain toatoa straddling a levee of Erua Stream that bisects Erua Swamp (Fig. 3). The remainder of the group are scattered cohorts of juveniles southward along the toe of a fault scarp marking the eastern edge of Waimarino Plateau. The generally poor health of many of the Erua *P. turneri*

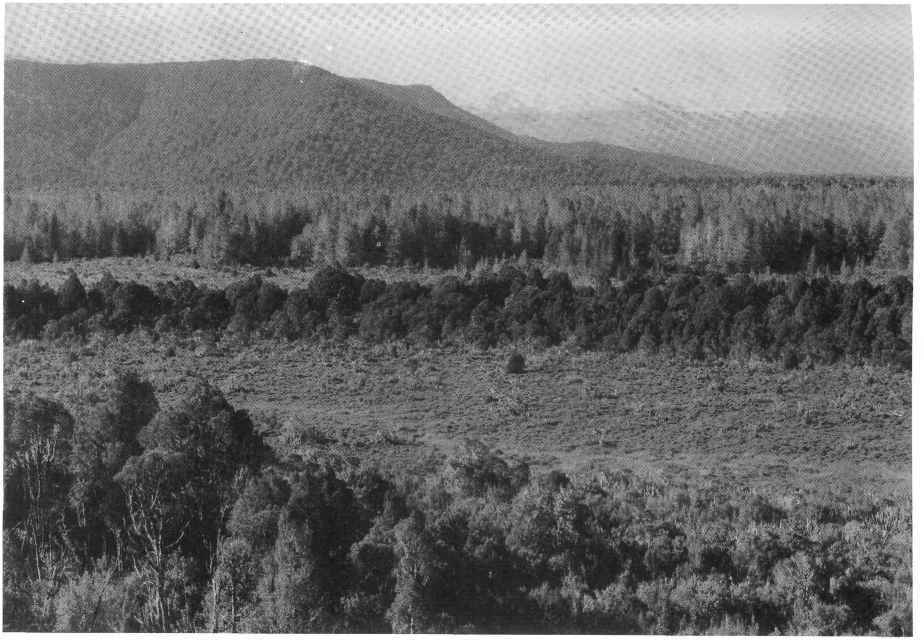

Fig. 4. The forested levees of Waimarino Stream at Erua and the *Pinus ponderosa* plantations beyond have abundant juveniles of *Pittosporum turneri*. Photo: C E Ecroyd

stands is probably attributable to physiological drought (and subsequent fungal attack, C E Ecroyd pers. comm.) induced by high watertables on swampy substrates rather than through frost or exposure.

Erua is also a biogeographically significant site in that *Pittosporum turneri* shares escarpment slope and levee habitats with *Olearia capillaris, Coprosma wallii, Melicytus angustifolius* and *Ranunculus ternatifolius* (Ogle and Druce, in Ogle 1983) all with very restricted North Island distributions and then disjunct to South Island.

The southernmost records of *Pittosporum turneri* are from Mangaohane Plateau and Ohutu Ridge in the high altitude plateau country of north-west Ruahine Range. The substrates here are andesitic ash in contrast to rhyolitic pumice elsewhere. The entire population is scattered along fire induced forest margins and natural stream and bog margins to the kaikawaka-pink pine forest that covers the marine sediment plateau (Rogers 1987). Mostly saplings, as isolated individuals or stands containing up to 24 plants, span the region from Ruahine Corner in the east to Aorangi mountain in the west. However, the most vigorous stands are concentrated along the Waiokotore Stream banks in secondary shrubland of mountain inaka-red tussock that occupies sites of Polynesian deforestation. Most of the population is healthy and extends to 1300 m in altitude on Ohutu Ridge east of Aorangi. A solitary sapling, recently discovered in a bog clearing within forest, is 4.5 m tall with an 11 cm diameter trunk and has vestigial adult foliage uppermost on the plant.

Nothing is currently known of the status or history of the final three records of the species near Te Kuiti, Otorohonga and at Rangataua. The two former sites are likely to have disappeared with farming development and if the latter were extant at Rangataua, a very accessible area, it seems unlikely that it would have escaped detection.

Conservation Status

The legal or statutory protection of *Pittosporum turneri* is important, not only because Given *et al.* (1987) believe the species requires monitoring but because the present low number of sites and contracted geographical range are products of continuing disturbance. The evidence is that deforestation of King Country, western Taupo, northern Tongariro and Moawhango has substantially reduced the abundance and range of the species. Nevertheless, we can predict from an ecological understanding of the species that not all stands have been uncovered. Further populations may occur on forest margins in west Taupo forests and Tongariro State Forest at least.

Two populations are formally protected. A State Forest Sanctuary was gazetted at Erua in 1954, primarily to protect *Pittosporum turneri*. Limited to 6.7 ha and coupled with the apparent ill health and ephemeral nature of stands at Erua, the size and ecological representativeness of the reserve appear inadequate. Ecroyd (1981) recommended an expansion of the reserve eastward to encompass several hundred juveniles beneath *Pinus ponderosa* stands on Erua Swamp. Ogle (1983) suggested a reserve extension south along the Erua escarpment to protect an intact sequence of forest types from the upper escarpment rim down to the levee of Waimarino Stream. The now defunct State Forests Scientific Reserves Advisory Committee recommended the abolition of the Sanctuary (a special Act of Parliament would be required), and the creation of a much larger, more ecologically viable and representative ecological area under the Forests Act. This proposal is currently in abeyance.

Thankfully, the Whenuakura Clearing is protected as the Whenuakura Ecological Area of 1764 ha, gazetted on 18.2.85. This valley contains forest, shrubland, bog, and swamp vegetation representative of Volcanic Plateau 'frost-flats'. But in view of the apparent ephemeral presence of each stand we cannot predict a continuity of the species at any particular site. For this reason alone, an expansion of the Erua reserve is highly desirable, while that at Whenuakura provides protection for extensive forest margin habitat that should ensure a viable long-term presence for the species.

Much of the southernmost population in the north-west Ruahine Range occurs on the Aorangi/Awarua block of Maori land. Fortunately, this land is unlikely to be developed for exotic forestry or farming.

REPRODUCTIVE BIOLOGY

Several aspects of the species' breeding biology are unknown. While we have anecdotal accounts of trees with adult foliage in the wild from the past and several herbarium specimens with seed capsules and flowers (NZFRI), currently no reproducing adults are known in the wild. Reproductively mature adults were noted in the 1940's through to the 1960's at Pureora, Whenuakura, Kuratau, Erua and Rangataua. That past seed sources were abundant can be deduced from the widespread extent of saplings but the presence of numerous young seedling populations are difficult to explain in relation to the absence of adult trees in the last 20 years. Perhaps adult trees remain undetected in the wild, but this seems unlikely. Alternatively, delayed germination of a long-lived seed bank in soil or litter may account for young seedlings. A further suggestion is that seed is produced by the widespread saplings currently without adult foliage. This also appears improbable as Pittosporums retain their conspicuous capsules for at least 12 months.

After unsuccessfully searching for adult trees in the wild in 1987, I was surprised to be shown a solitary tree covered in blossom in the grounds of the Soil Bureau at Taita, Hutt Valley (Figs 5 and 6). This 30-year-old tree planted by A P Druce, has mostly adult foliage, is 6 m tall and has a 14 cm diameter trunk. Only 3 capsules, all containing seed (of unknown viability), showed that the tree had flowered the previous year but had failed to set a substantial quantity of seed. Morphologically, the flowers appeared hermaphroditic (Fig. 5). Nevertheless, several factors point to the flowers as being functionally male. Godley (1979) shows that male flowers of *Pittosporum* can have a fairly well developed ovary, but smaller than that of female flowers. Male flowers also have poorly developed stigmas. This and the limited seed set (again 3 capsules only in 1988) indicate that this is a male plant of this dioecious species.

The Taita plant flowered for only 2-3 weeks in November, suggesting flowering events in the wild may go undiscovered if adult trees are limited in number. That the plant had adult foliage reinforces the conclusion drawn from herbarium specimens that saplings with the divarcating habit (as all are in the wild), probably do not reproduce.

Seed Dispersal

Like most New Zealand Pittosporums this species has seed apparently adapted for bird dispersal. Judging from the apparent rarity or absence of adults and the wide and abundant extent of juveniles at many sites, birds are probably an efficient dispersal vector. Notwithstanding this, the tightly clumped distribution of many cohort stands of saplings and seedling at sites previously disturbed by

Fig. 5:
The terminal umbels of flowers. What appear to be hermaphroditic flowers are in effect functionally male on this plant growing in cultivation at Taita, Hutt Valley, November 1987.
Photo: G M Rogers

Fig. 6:
Single flower from the umbel in Fig. 5, again showing apparently hermaphroditic characters.
Photo: A P Druce

fire and devoid of suitable bird perches is evidence for abundant germination of seed beneath a previous adult tree.

Architecture

Three *Pittosporum* species in New Zealand have strong heteroblastic development (with two or more distinct forms) both in foliage and in habit, *Pittosporum patulum, P. turneri* and *P. virgatum.* In particular, *P. turneri* transitions from a seedling with loosely tangled branchlets, similar in form to a seedling matai, to a column-like or cylindrical sapling with tightly divaricating branchlets (Fig. 2). Furthermore, the branches of the sapling mostly radiate from nodes and subsequently become pendulous. This habit and the tightly interlaced branchlets produces a sequence of 'skirts' of twigs enveloping the trunk. These 'skirts' produce a rigid exterior to the sapling which, some may infer, provides an effective antibrowse deterrant to the plant. Certainly, the bark of *P. turneri,* where it is infrequently accessible between the wiry mass of branchlets, is browsed by deer, and possums browse the minute leaves of the saplings.

Although we have no recent accounts of the habit of adult trees, the leaves as depicted in Eagle (1975) are crenately obovate and historical reports suggest adult trees develop upright branches that form a mushroom-shaped profile to the tree.

Longevity

The species seems to be locally ephemeral and particularly short-lived for native woody species. For instance, there are abundant juvenile populations with no adults; many tall saplings approaching adulthood have died or are debilitated at several sites; and the age of several recently dead or healthy sub-mature shrubs all suggest a species of limited longevity. These factors also point to a short reproductive life for adults although it is unlikely the species is monocarpic as are some bamboo species. Cores from 10-12 cm diameter trunks on Mangaohane Plateau returned ages of 38, 38 and 43 years while 4 dead older saplings at Erua were 32, 36, 36 and 42 years for 4-6 cm diameter trunks. The flowering tree at Taita is approximately 30 years old and it will be interesting to note its longevity in cultivation.

Ecological Equivalence with *Pittosporum patulum*

We might usefully examine the ecological equivalence of *Pittosporum turneri* and the endemic South Island species *Pittosporum patulum.* Adult trees of *P. patulum* are unknown in northern South Island in Cobb Valley (North-west Nelson), Richmond Ra or Raglan Ra (Marlborough). One adult only has been noted in recent times (A P Druce pers. comm.) in the Wairau Valley, Marlborough, although others were recorded in the 60's and 70's. The species displays a bimodal ecological distribution occurring both as dense thickets of juveniles exploiting recently disturbed open sites, or as widely dispersed juveniles in forest understoreys of northern South Island. Clearly, *P. patulum* is shade tolerant in contrast to *P. turneri.* Birds appear to be an efficient seed dispersal agent when accounting for the distribution of juveniles in both habitats. But although *P. patulum* displays the heteroblastic habit, it is not included in Greenwood and Atkinson's (1977) list of New Zealand divaricating plants. So while there are striking morphological and habit similarities in the two species, e.g., heteroblastism and general absence of adults, the ecological roles of the species are dissimilar.

CONCLUSION

In conclusion then, *Pittosporum turneri* is a forest margin species with life history attributes that can ensure local survival after disturbance. The species appears short-lived and progresses in form through three quite distinct developmental, architectural stages. The wild population is probably devoid of adult plants currently, an absence apparently linked to widespread adult mortality some 20 years past. However, the possibility remains that lurking out there on bogs and forest margins of central North Island, are adult trees which have avoided detection despite the diligent efforts of many observers in the last 20 years.

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Footnote:

Members of the Rotorua Botanical Society saw 40 flowering plants of *P. turneri* at Whenuakura on 12 November 1988. Flowers appeared to be functionally dioecious and were associated with adult foliage only; lower parts of all plants bore juvenile foliage.

Book Reviews

Weltands: Discovering New Zealand's shy places. *Gordon Stephenson. Government Printing Office Publishing, 1986. 117 pp, 8 pp colour plates, 13 black and white photographs, 50 line drawings, 3 location maps. $16.95 incl. GST.*

Gordon Stephenson describes his reason for writing this book in his Preface: "I've had a long-standing affection for steep mountains and wild coastlines and the deep bush, but of wetlands, I knew and cared little . . . I am not a botanist, zoologist, or geologist, but rather an amateur in the sense that I became enthused and wished to share the pleasure and excitement with others." Gordon Stephenson anticipates that there are others like him who have yet to discover the delights of wetlands, thinking them only uninviting and unattractive. He hopes his book will help some of these people discover New Zealand's shy places, its wetlands, all the sooner.