Notes towards an Excursion Flora: manuka (*Leptospermum scoparium*, Myrtaceae)

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My interest began with a commercial herbalist wanting to know whether his sample of broken leaves was manuka (*L. scoparium*) or kanuka (*Kunzea ericoides*, formerly *L. ericoides*). We thought this would be easy to tell, but in fact the leaf descriptions in our Floras are quite uncritical — the distinctively pungent tip of the manuka leaf seems to have acted to deter further comparisons being made.

So I was surprised, having put leaves of the two side by side under the dissecting microscope, to see how different they are. And especially to see that manuka leaves are minutely toothed along their edges — a feature which logically would expel the plant from its family! These teeth are largest at the places where the long silky hairs of the margin, conspicuous on the newly emerging leaves, have been attached. They are quite without a vascular supply.

Such a striking and constant feature would have satisfied my employer, but another remarkable difference came to light.
I had prepared "cleared" leaves, that is, leaves whose protoplasm is dissolved out in hot alkali, when the resistant tissues, in particular the lignified ones, become conspicuous. Cleared leaves of manuka show just the vascular tissue, that is, the lignified water-conducting members in the (usually 5) nerves and cross-veins. But in kanuka the sheathing tissue around the (usually 3) vascular strands and the cross-veins is also slightly lignified; this considerably widens the cross-veins in outline and so gives the cleared leaf a cloudy, tattooed appearance (Fig. 1).

The clearings also show how the difference in pungency arises: in manuka the central veins and the two main laterals join and are prolonged together right to the apex, but in kanuka they just make an indefinite join some way short of the apex, where the midrib ceases.

Identification of leptospermums is a serious matter in Australia, where there are 79 spp. (Thompson 1989), including *L. scoparium* . It seems that there too the details of the manuka margin have been detected only recently (Burbidge and Gray 1970; Willis 1972).

As a kind of sympodial addendum I have illustrated in Fig. 1 C-E something of the arrangement of the flowers of manuka, if only to show again that parts of this "well-known" plant are not without interest. It seems, on the interpretation of Briggs & Johnson (1979), that although the flowers appear terminal on their short shoots they are actually subapical and axillary. Dissecting the 2 mm diameter scaly buds to verify this has been a frustrating exercise — the scales lack much indication of their midlines and tend to be swaddled in hairs below. All my conclusions need to be checked by serial-sectioning.

I think I have been able to follow the 2/5 phyllotactic arrangement of the scales up as far as the one which encloses the vegetative bud. Usually this bud is not neatly centred at the scale's base but sits off to one side, evidence I suppose that it is terminal rather than axillary. The next scale (in the spiral or not?) is the flower-enveloping bract; one has to suppose that it "belongs" to the base of the vegetative bud. The next two scales, the bracteoles, also close over the top of the bud completely. I am not sure whether they might be opposed to one another rather than continuing the spiral.

A partial description of manuka, as non-static as my knowledge allows, is given here, along with the kind of notes some of which a well-prepared Excursion Flora might contain.

Leptospermum scoparium J. R. & G. Forst.

Small tree to c. 10 m tall and 30 cm dbh, trunk often crooked and fluted, never suckering at base; bark mid-brown, detaching in rather stiff irregular flaky strips; heartwood crimson.

Foliage bluish green in life, odorous when crushed, with eucalyptus and sweet floral odours; life-span of leaves unknown; new shoots and leaves with silky hairs to c. 1 mm long (c. 3x as long as those of kanuka); leaf blades usually 2-3 mm wide, elliptic-obovate, apex pungent, margins minutely serrulate (just visible at x 10), nerves 3-5(-7), bundle sheaths well-developed but not lignified, in the midvein often with an extension to the abaxial surface.

Flowers mostly produced in late winter, at first enclosed in scaly buds, solitary and appearing to terminate short lengths of shoot but (*f.* Briggs & Johnson) actually lateral just below the apex of these, a small terminal vegetative bud also present at this time and this often growing on (during fruit development?) to give the shoot a falsely sympodial appearance.

Capsules with rather fleshy wall and top, persisting unopened on stems long after the surrounding leaves have fallen.

Distribution Widely distributed in New Zealand; adventive to Chatham Is. (Madden & Healy 1959). Also in south-east Australia (far south of NSW to the Grampians in western Victoria): once found, apparently naturally, in the Cook Is. (Rarotonga).

Ecology Intolerant of shade, hardy to frost, moderately resistant to waterlogging, resistant to drought except perhaps on pumice soils. Commonly attacked by a black smut (Mulcock 1954). Pollination by beetles and flies at least (Heine 1938; Godley 1979). Regenerating gregariously on bared ground, especially after fire, which promotes capsule-opening.

Maori names manuka, kahikatoa.

Notes Useful things the pre-European Maori made with the strong and stiff manuka wood include fish hooks, canoe decking, and a special type of war spear for penetrating between palisades (Riley 1997). For medicinal uses see that author, and also Brooker et al. (1991).

The wood of manuka lasts especially well in the ground and so had particular uses in pioneer New Zealand agriculture, e.g., as fascines in tracks across swampy ground and in ditch crossings (heads of the bundles laid downstream), as temporary fencing, and as stakes of various sizes to support beans, tomatoes, grapes and hops. West Auckland's pipe-making industry began in the 1850s with R. O. Clark of Hobsonville firing clay-wrapped "small trees" (Scott 1979); almost certainly these were of the district's dense (and so straight-trunked) stands of manuka, some of which survived on the pottery site until the 1980s. Dry manuka is a very good firewood, hot and fragrant, and manuka sawdust has some current use in smoking meat and fish. Manuka honey is one of NZ beekeeping's most valuable products.

There are numerous horticultural selections of manuka, mostly with pink or ruby red flowers; these are grown in California etc.

Acknowledgments
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Figure 1 opposite

Leaves of manuka (2.5 mm wide) and kanuka (1.8 mm wide).

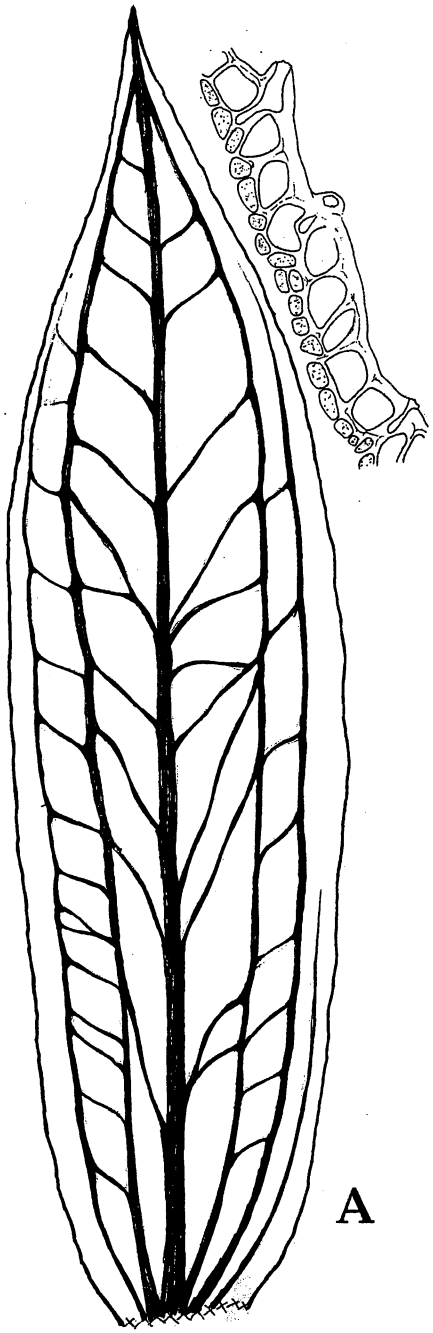
A. Manuka, cleared to show vascular strands (nerves usually 5, sometimes 7). Reticulation between nerves mostly omitted. Enlargement (c. 1 mm long) to show serrations, at places formerly bearing hairs (epidermal cells clear, ground tissue stippled).

B. Kanuka, cleared to show vascular strands (nerves usually 3, sometimes 5). Enlargement to show extent of lignified bundle-sheaths around nerves and reticulation.

C. Piece of shoot, flower apparently terminal, with a vegetative bud at its base (arrowed). Capsule ripening fruit lower down, note the sympodial appearance of this length of shoot.

D. Diagram to show relationships of axes, flowers (circles), vegetative buds (arrow-heads, barred if abortive), and capsules (turbans). Dashed lines represent non-elongate axes.

E. Dissected-out bud scales (placed in phyllotactic spiral starting lower left), vegetative bud arrowed; above, the bract (br), and two bracteoles attached to the axis.



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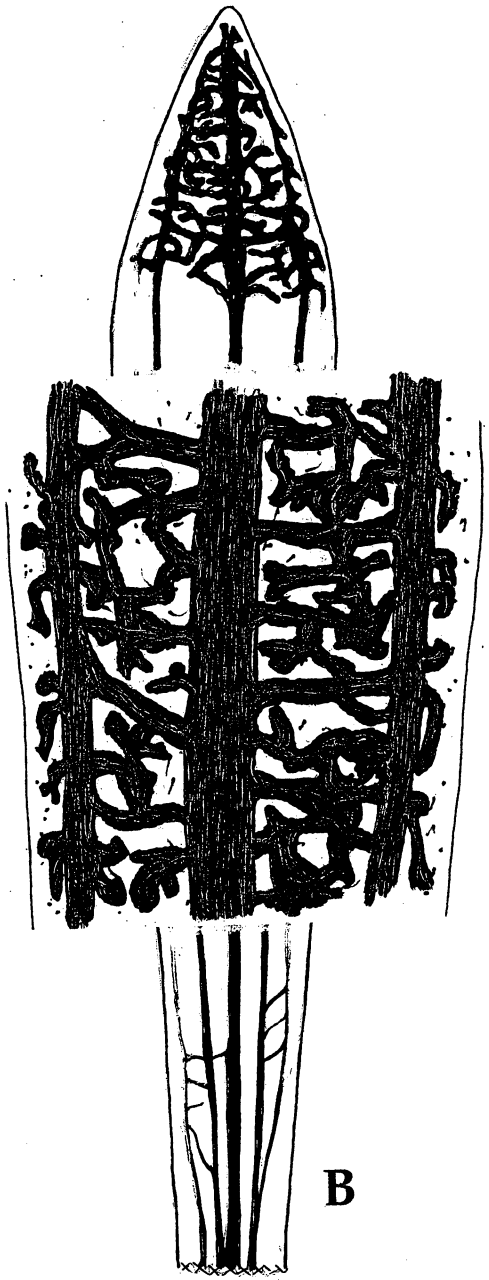

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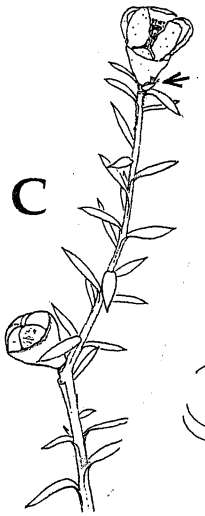

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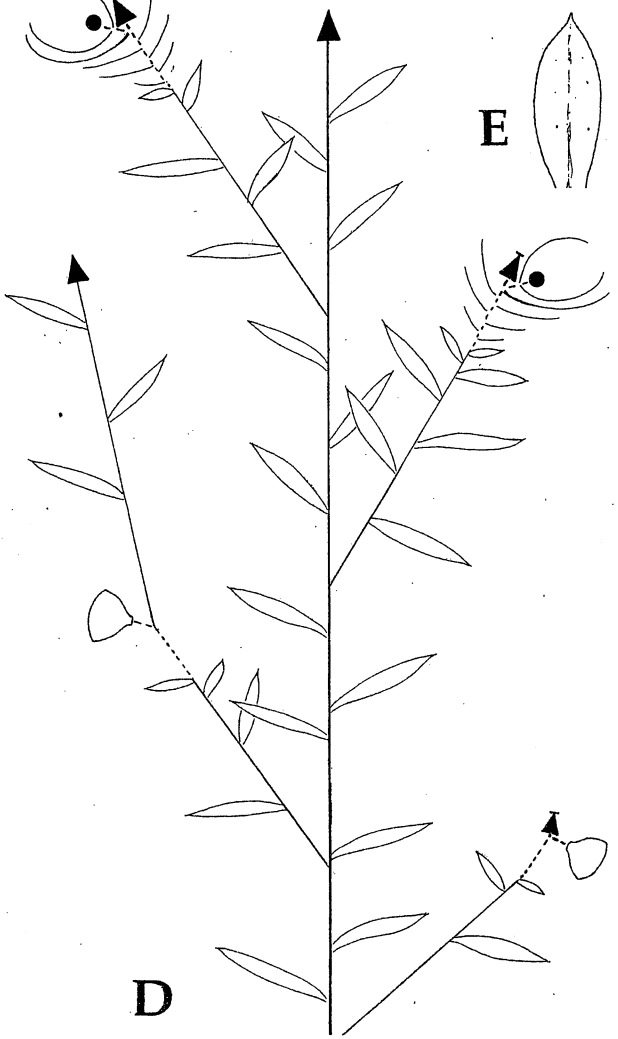

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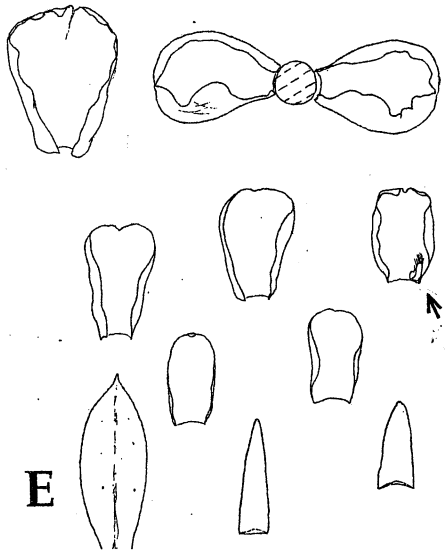

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