

Indigenous Knowledge and Pharmaceuticals

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The early European explorers were intrigued by the fact that humans could exist in the harsh and forbidding environment of the Australian desert. Colonel Peter Egerton-Warburton, one of the first explorers into the north-western area of Central Australia commented 'The country is terrible. I do not believe that men ever traversed so vast an extent of continuous desert'.¹ The truth was that desert Aboriginal people did cross the desert and their ability to survive in this environment of extremes is a testament to their inventiveness and adaptability. A strong link was forged between these desert dwellers and the land over countless generations. An intimate knowledge of the land and its resources, and the ability to manage and utilise them, provided the desert people with material and spiritual sustenance. Plants played a crucial role as a source of materials, implements, food, medicine and also as suppliers of the most important factor in desert survival — water. It follows that a good knowledge of the botany of the regions they traversed was required to identify and distinguish food, medicinal and poisonous plants. Their extensive use of medicinal plants has been realised only recently and several attempts to collect this knowledge before it is irretrievably lost have been made. In the sequel, the use of plants as medicines by the desert Aboriginal people is considered. A case study involving *Eremophila* species, members of which were commonly used for medicinal purposes, is presented to illustrate that the use of remedies prepared from these plants have pharmacological validity.

The Aboriginal people arrived in Australia from the tropical north and settled the continent more than 50,000 years ago. The isolation of the land mass meant that they had to adapt to the unusual and unique flora available and to identify those plants that could be used for curative purposes.² New plants would have been tested for their effect in treating illnesses by a process of trial and error; the sick, frail and elderly probably serving as test subjects. Once established as a useful species, information about a plant was passed on by word of mouth to the next generation of 'medicine men'.

It is important to realise that the plant medicines required by the desert people did not have to work miracles since life-threatening diseases were not common. Contagious and infectious diseases such as cholera, smallpox, tuberculosis, measles and mumps were unknown until the arrival of the first European settlers.³ Most problems were related to skin disorders, antiseptic needs, fever, rheumatic pain, sprains, wounds and burns, in which case plant preparations were used externally as skin washes.⁴ Infusions and decoctions were also prepared, a few of which were taken for internal complaints. Reportedly, these were used as analgesics, expectorants and abortifacients, as well as for treating colds, influenza and headaches.⁵ Internal complaints were considered to be spiritual in nature, and were often treated by spiritual means through the agency of the 'medicine men'. It comes as no surprise to find that only approximately 10 per cent of Aboriginal medicines were ingested to treat internal disorders.⁶

The leaves and the bark were the plant parts most commonly used in the preparation of bush medicines.⁷ The plant material was treated by grinding, bruising or maceration processes, followed by extraction for decoctions and infusions. Inland Aborigines, who did not have access to boiling implements, carried out their extractions by soaking the plant material overnight in water or by pounding to make a paste which was mixed with fat to prepare an ointment. Those living in coastal regions used old baler shells to boil plant material.⁸

Because of their nomadic nature, the Aboriginal people would have targeted a variety of plants with a broad spectrum of medicinal uses rather than carry several species with them. Of the 70 plant species known to have been used for therapeutic purposes, about a third were either *Acacias* or *Eremophilas*. In particular, a number of *Eremophila* species featured prominently in the cultural, religious and material aspects of everyday life.⁹

Eremophila (Myoporaceae) (Gr. *Eremos*, desert; *phileo*, to love) is a genus unique to Australia. It is of widespread distribution and occurs along the coastal margins and the hinterland, but is virtually absent in tropical zones. This preference for areas of low rainfall and high temperatures has led to an abundance of the genus in the semi-arid and arid zones of Australia. Many of the 300 or so recognized species and sub-species are tolerant to droughts, fire and grazing, as well as to light frost, and are often found flourishing in poor soils.¹⁰ The name 'emu bush' is also commonly used and is derived from the fact that emus (*Dromaius novahollandiae*) feed on the fleshy fruits of some species, eg. *E maculata*.¹¹

It is of some interest to note that a high proportion of *Eremophila* species were used to prepare medicines to deal with internal complaints. Of these, *E alternifolia* and *E longifolia*, appeared to be important in the pharmacopoeias of the Australian Aboriginal people.¹² *E alternifolia* was considered the 'number one medicine' by some tribes¹³ and it was one of few species in which the leaves were harvested, dried and carried around in case of need.¹⁴ Infusions of *E alternifolia* leaves were used to treat colds, influenza and headaches,¹⁵ to induce sleep¹⁶ and pleasant dreams.¹⁷ They apparently showed analgesic and decongestant properties and were reported to promote general well-being.¹⁸ *E longifolia* is a plant of sacred and mystical significance to the Aboriginal people.¹⁹ Its medicinal uses include the burning of *E longifolia* twigs ('smoke treatment') near trenches, in which newly born babies and their lactating mothers lay. Reportedly, this induces lactation in the mother and strengthens the babies.²⁰ In addition, decoctions of the leaves were used as eye washes,²¹ as counter-irritants²² and for skin and body washes.²³ An infusion of the leaves was prepared for colds and headaches²⁴ and this treatment was reported to induce restful and restorative sleep.

Of the curative properties attributed to these plants, those associated with a feeling of well-being and induction of restorative sleep suggested to us a possible cardioactive action. We therefore sought to establish if extracts from these plants showed cardioactivity and, if so, to isolate and identify the active principles.

A methanolic extract from the leaves of *E alternifolia* was tested on Langendorff rat hearts and was shown to mediate significant increases in heart rate (chronotropism), contractile force (inotropism) and coronary perfusion rate (CPR) (Pennacchio *et al.*, 1995). The active constituent in *E alternifolia* leaves was identified as the known phenylethanoid glycoside, verbascoside. Its effects on the Langendorff rat heart were identical to those induced by the methanolic extract

of *E alternifolia* leaves, but were more pronounced. A solution of verbascoside (1ml of 1 mM) increased chronotropism, inotropism and CPR in rat hearts in a dose-dependent manner.²⁵ Subsequent studies have shown that verbascoside increases the intracellular levels of a messenger (cyclic 3, 5'-adenosine monophosphate; cAMP).²⁶ The increase in cAMP production appears to occur in response to an increase in prostacyclin. Significant increases in the levels of this hormone-like substance were detected in hearts treated with verbascoside.²⁷

The presence of verbascoside in *E alternifolia* leaves may explain why this species was so highly 'prized' by the Aboriginal people. Verbascoside has been shown to have a range of pharmacological activities including antibacterial, antioxidant and analgesic effects.²⁸ Its ability to dilate blood vessels and reduce blood pressure²⁹ may account for the reports that infusions of *E alternifolia* leaves helped to induce sleep and promote general well-being.

Pharmacological testing of the methanolic extract of *E longifolia* leaves indicated that it also displayed cardioactivity. However, a biphasic effect on the Langendorff rat heart suggested that more than one active compound was responsible for the cardioactivity observed.³⁰ The major active constituents were identified as geniposidic acid and verbascoside. Unlike verbascoside, which had a positive effect on rat hearts, geniposidic acid (1ml of 1 mM) significantly inhibited chronotropism, inotropism and CPR.³¹ The presence of two bioactive compounds with apparently opposite action is interesting. In particular, the effects induced by the two compounds are not in phase, thus exerting a stabilising effect on the heart action.

In an extension of this study, three other species of *Eremophila* were shown to contain compounds similar to geniposidic acid that significantly altered myocardial activity in the isolated rat heart preparations.³² The multifaceted pharmacological actions of verbascoside, geniposidic acid and related compounds are well documented.³³

These results indicate that, at least for the more commonly used *Eremophila* species, the desert Aborigines had selected plants with distinct curative properties. All the effects attributed to medicines prepared from these plants cannot be rationalised by the presence of verbascoside and geniposidic acid alone. Since both species contain a number of other compounds, it is probable that some of these may contribute to the other beneficial effects associated with these preparations. For example, *E longifolia* contains large amounts of volatiles (up to 6 per cent essential oil) consisting of saffrole (anaesthetic and bactericidal action) and methyl eugenol (anaesthetic, bactericide, fungistatic, sedative actions). It is possible that the presence of these compounds might explain the use of this plant for preparations for eye, skin and body washes and as a counterirritant.

In conclusion, the use of traditional knowledge as a guide to discovering new medicines (ethnopharmacology) has proven to be valuable in our studies and those of others. Ethnopharmacology is a multidisciplinary study involving both the *natural sciences* (chemistry, medicine, botany and pharmacology) and the *humanities* (history, linguistics and ethnology). Aimed primarily at investigating age-old practices and cultures, it affords a better understanding of the therapeutical basis of traditional healing methods and also helps preserve traditional medical practices and knowledge.

Indigenous Knowledge and Pharmaceuticals
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Notes to pp 209–212

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