MONOGRAPH FOR *TASMANNIA LANCEOLATA* (TASMANIAN PEPPER BERRY)

BOTANICAL NAME

Tasmannia lanceolata (T. lanceolate) is a shrub which is endemic to the woodlands and cool temperate rainforests of Tasmania and the south-eastern region of the Australian mainland.

COMMON NAME(S)

Tasmanian pepper, Mountain pepper, Tasmanian pepper leaf, Tasmanian pepper bush.

PART USED

The berries, leaves and bark have traditional use as a medicinal plant.

TRADITIONAL USAGE

Tasmannia lanceolata was used as flavouring agent by Australian Aborigines and more recently by European settlers. Traditionally, the leaves have been used as a herb and the berries have been used as a spice. Australian Aborigines also used *Tasmannia lanceolata* as a therapeutic agent to treat stomach disorders and as an emetic, as well as general usage as a tonic. Reports also exist of the use of *Tasmannia lanceolata* by Australian Aborigines for the treatment and cure of skin disorders, venereal diseases, colic, and stomach disorders. European colonists also recognized the therapeutic potential of *Tasmannia lanceolata* and the bark was used as a common substitute for other herbal remedies and to treat scurvy due to its high anti-oxidant content.

DESCRIPTION OF THE PLANT & ACTIVE CONSTITUENTS

Phytochemical analysis of the *Tasmannia lanceolata* extracts indicated the presence of saponnins, phenolic compounds, flavonoids, polysteroids, tripenoids, cardiac glycosides, anthraquinones, tannins and alkaloids.

SCIENTIFIC STUDIES

Until recently there have been limited rigorous scientific studies into the therapeutic properties of Tasmannia lanceolate. Recent studies have demonstrated the high antioxidant content of *Tasmannia lanceolata* fruit and leaves. It has been suggested that this high antioxidant content may provide therapeutic effects.

Another interest in the therapeutic uses of *Tasmannia lanceolate* is its antimicrobial properties. *Tasmannia lanceolate* extracts have been shown broad-spectrum antibacterial and antifungal activity.

Polygodial is the active component in *Tasmannia lanceolata*. Studies have reported the therapeutic properties of polygodial, including its anti-bacterial, antifungal, anti-hyperalgesia, anti-inflammatory, anti-allergic and vaso-relaxation activities. Several studies have also reported protozoal growth inhibitory activity for polygodial. Studies have also reported the induction of significant intracellular structural changes including mitochondrial swelling, loss of microtubule organization and membrane damage following exposure to polygodial.

One study showed that that combination of polygodial with anethole displayed fungicidal activity again *Candida albicans, Saccharomyces cerevisiae, Salmonella choleraesuis,* and *Penicillium crustosum*. The antifungal mechanism of polygodial is suggested to be its ability to function as a nonionic surfactant, disrupting the lipid–protein interface and denaturing integral protein conformation in the cell membrane of the organism.

Studies have reported potent inhibition of bacterial growth by *Tasmannia lanceolata* berries, leaves and peppercorns. One study showed that *Tasmannia lanceolata* berry and leaf extracts displayed significant inhibitory activity against *Giardia duodenalis*. The methanolic and aqueous extracts of both berry and leaf, and the berry ethyl acetate extract, were particularly potent, each inhibiting 100% of the Giardial proliferation (compared to the untreated control) in less than 15 minutes.

Recent studies have reported *Tasmannia lanceolata* to be an extremely good source of antioxidants. *T. laceolata* has been reported to have free radical scavenging activities more than 4 times higher than blueberries despite having ascorbic acid levels below the level of detection.

Tasmannia lanceolata is particularly high in terpenes, flavonoids and phenolic compounds but also has high levels of a variety of other antioxidants, including anthrocyanins and anthrocyanins glycosides. Antioxidants have been associated with the prevention of cancer, cardiovascular disease and neurological degenerative disorders. They are also linked with anti-diabetic bioactivities and have been associated with the reduction of obesity. Antioxidants can directly scavenge free radicals, protecting cells against oxidative stress related damage to proteins, lipids and nucleic acids.

Tasmannia lanceolata are also a rich source of lutein, vitamin E, vitamin A and folic acid. The glycosides quercetin and rutin are some of the other antioxidants present in the fruits and leaves.

High antioxidant plants such as *Tasmannia lanceolate* also have potential in the maintenance/control of diabetes mellitus. Glycosylation of blood proteins including hemoglobin, albumin and lipoproteins is characteristic of diabetes mellitus. Under the hyperglycemic conditions, blood glucose interacts with specific amino acids on the surface of proteins, forming glycosylated protein products. These undergo a series of further chemical modifications, resulting in the production of advanced glycation end products (AGE). The binding of AGE's to their receptors results in altered cell signaling which in turn results in free radical production. Studies have directly linked oxidative stress with the impaired maintenance of glucose homeostasis and the enhanced lipid peroxidation seen in diabetes mellitus.

Oxidative stress induction has been suggested to be the common link between numerous diverse medical complications including, cardiovascular disease, renal and neural degeneration, impaired vision and erectile dysfunction, seen in diabetes mellitus. Treatment with antioxidants would be expected to counteract many of these complications.

Recent studies have reported very high levels of antioxidant flavonoids and flavonoid glycoside compounds in *Tasmannia lanceolate* extracts compared to the levels in other plants. These flavonoids include quercetin, rutin, cyaniding-3-glucoside and cyaniding-3-rutinoside. There is evidence that similar bioflavonoids prevent oxidation of LDL cholesterol via there free radical scavenging activity, inhibiting endothelial activation and inhibit platelet aggregation. These also possess cyclooxygenase inhibitory activity and can prevent thrombosis. Evidence exists that the ingestion of high dietary levels of flavonoids is inversely proportional to the risk of coronary artery disease.

Recent studies have indicated that these phenolic compounds also have potent anti-inflammatory activities. These anti-inflammatory effects are likely due to the inhibition of the enzymes cyclooxygenase and lipoxygenase, resulting in the inhibition of prostaglandin and leukotriene synthesis and the downstream release of cytokines. Quercetin in particular has been shown to have potent inhibitory effects on both cyclooxygenase and lipoxygenase enzyme activities via its antioxidant activity.

MECHANISM OF ACTION

Bioactive applications – antioxidant, antidiabetic and antimicrobial properties.

TOXICITY

Leaf and berry extracts of *Tasmannia lanceolata* seem to be of low toxicity potential or are considered nontoxic.

TOXICOLOGY

No adverse reactions have occurred or have been reported in studies.

USE IN PREGNANCY & LACTATION

Avoidance or caution should be exercise in pregnancy and lactation as little is known of its effect in humans.

HERB/DRUG INTERACTIONS

Limited information is available indicating any herb and drug interactions of Tasmannia lanceolate. No herb or drug interactions have been noted or reported in studies so far.

SUMMARY OF INDICATIONS & SUPPORTING STUDIES

Indication	Intervention	Outcome	Reference
Giardia duodenalis	Polygodial from berry & leaf extract.	Significant inhibitory activity against *Giardia duodenalis.* Disrupts the lipid–protein interface and denatures integral protein conformation in the cell membrane. Mitochondrial swelling, loss of microtubule organization and membrane damage following exposure to polygodial	Rayan et al. 2016, Winnett et al. 2014
Inflammation	Phenolic compounds (quercetin) extracted from leaves and berry extract.	Inhibits the enzymes cyclooxygenase and lipoxygenase, resulting in the inhibition of prostaglandin and leukotriene synthesis and the downstream release of cytokines.	Cock 2013.
Oxidative stress	Leaf and berry extract	Prevents oxidation of LDL cholesterol, reduces oxidative stress and improve antioxidant status, free radical scavenging activity, prevents thrombosis and coronary heart disease	Cock 2013, Sultanbawa et al. 2016, Konczak et al. 2010.
Diabetes Mellitus	Flavonoid and phenolic compounds extracted from the leaf and berry extracts.	Potential to maintain and control diabetes. Antioxidant treatment may help reduce medical complications associated with diabetes – CVD, erectile dysfunction, impaired vision, renal and neural degeneration. Helps maintain glucose homeostasis and reduce lipid peroxidation.	Cock 2013, Winnett et al. 2014, Konczak et al. 2010, Rayan et al. 2016.

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