



**UNIVERSIDAD
DE LA FRONTERA**
FACULTAD DE CIENCIAS
AGROPECUARIAS Y MEDIOAMBIENTE

Exploring Patagonia's Native Resources for Medicines

"Global Health, Biodiversity, and New Medicines" Seminar
Cambridge, MA – June 9, 2023
Harvard University Herbaria

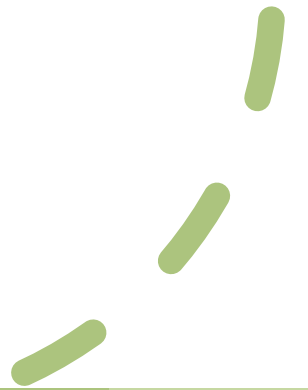
Dr. PAMELA LEAL-ROJAS
Dr. ADISON ALTAMIRANO

June 2023



Outline

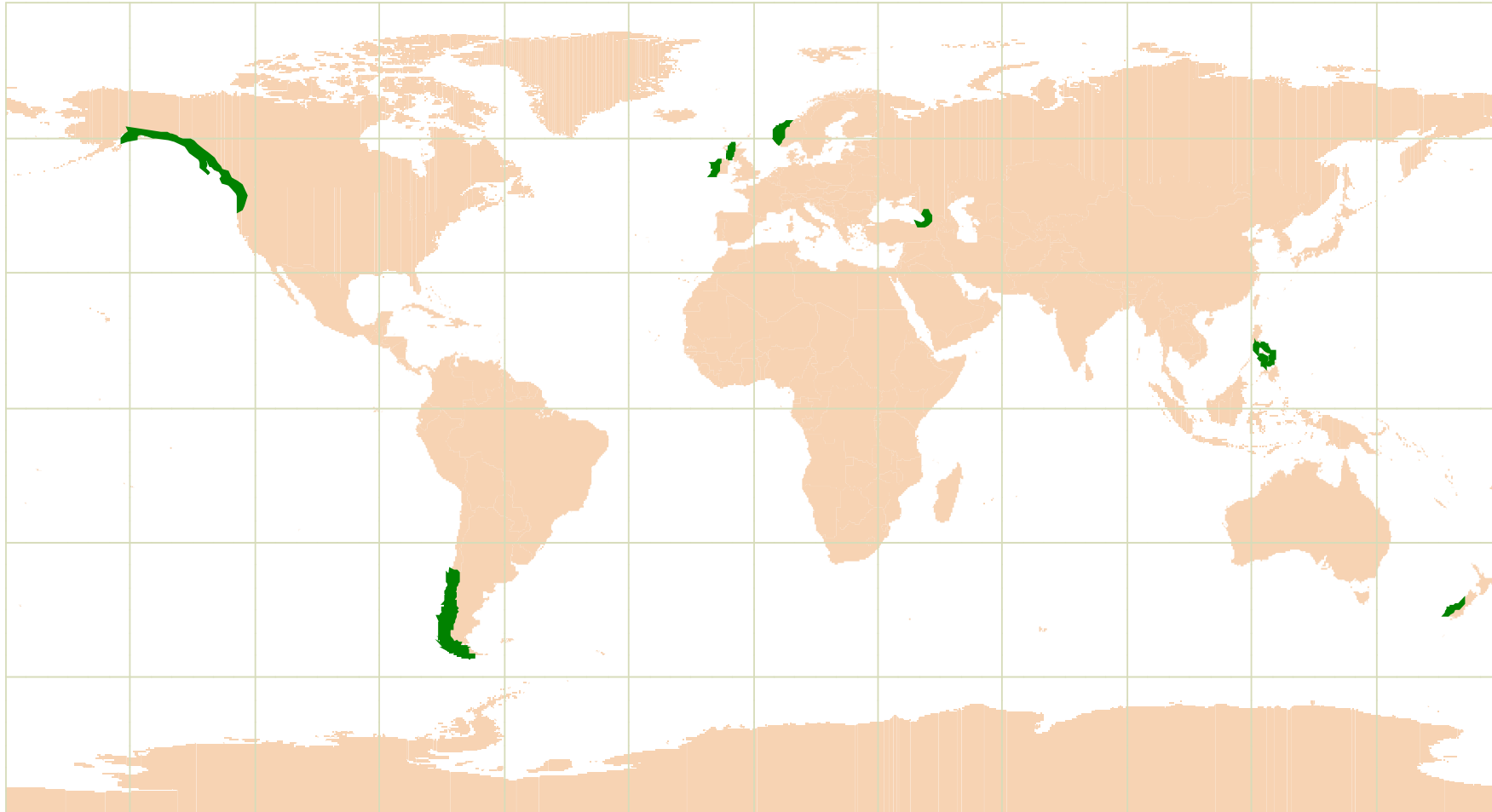
- Chile: a biogeographical island
- Biodiversity hotspot (Patagonia)
- Experimental land area at UFRO
- Chilean Berries with biological properties
- Exploring the potential of other natural trees for medicinal applications
- Collaboration networks



Background

- Chile is a geographical “island”: Andean mountain, Pacific ocean, Atacama desert, Antartica.
- High endemism in plants and animals (Armesto et al. 1995)
- Cool temperate rainforest region of Chile (Lat. 36.5°–54° south) is the second largest remaining area of this type in the world (Wilcox 1995)
- Internationally recognized for its ecological importance (Davis et al. 1994, Olson & Dinerstein 1998)

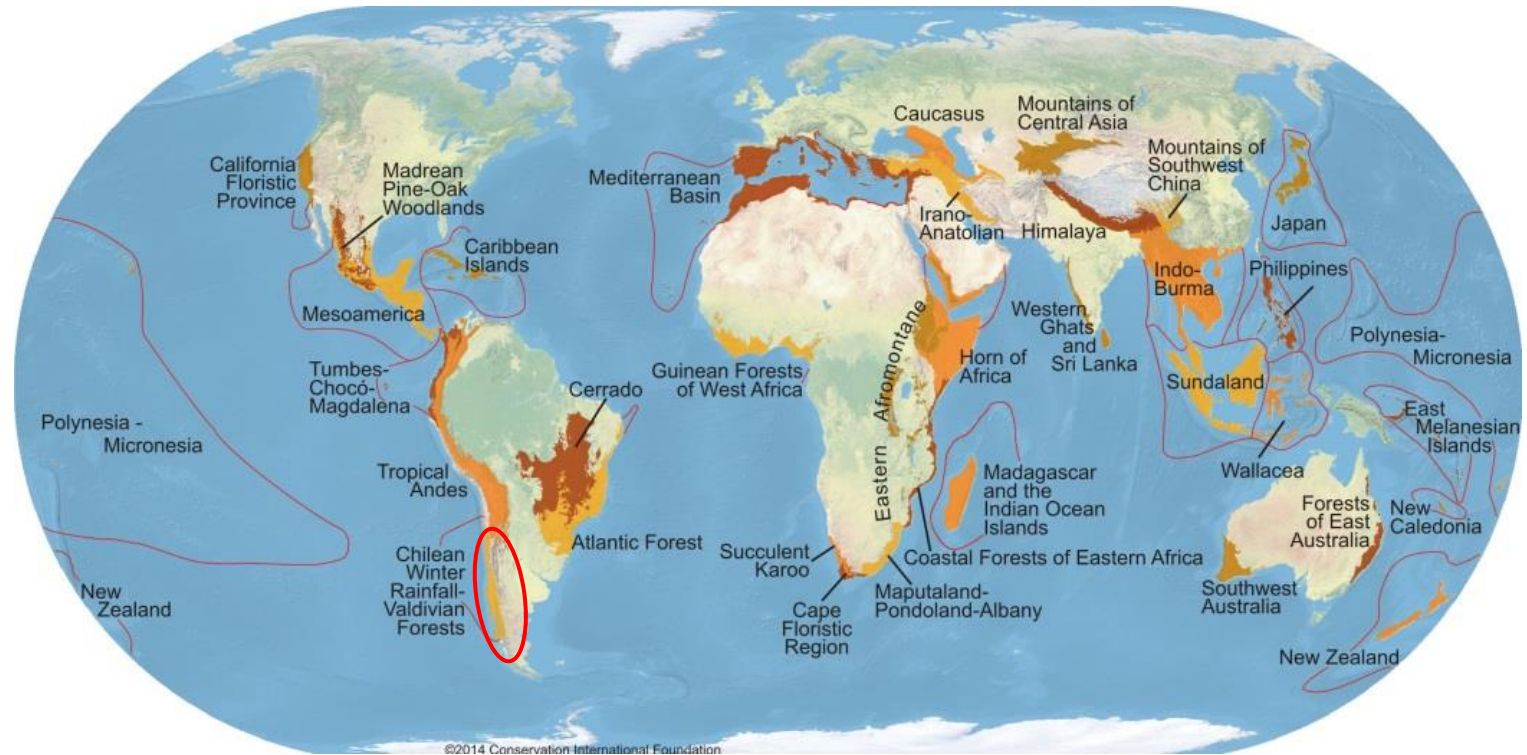
TEMPERATE ECOSYSTEMS



50% of the world's rain forests are found in the southern hemisphere
54% of the world's rain forests are found in the southern hemisphere

A global biodiversity hotspot

- Temperate ecosystems: one of the 35 global biodiversity hotspots: endemism y monotypic genus (Mittermeier et al., 2004)
- One of the most threatened regions of the world by Global 200 Initiative and recent studies (Altamirano et al., 2020)
- Chile is a relevant hotspot for biodiversity conservation and a source of unique bio-resources with medicinal potential (Otero et al., 2022)



Experimental land area at UFRO

LATERCERA

Adison Altar



Qué Pasa de La Tercera

26 ENE 2023 00:54 PM

Tiempo de lectura: 4 minutos

Este es el laboratorio con algunos de los robles más altos y antiguos del mundo

Se trata de un parque en el sur del país que mantiene uno de los últimos bosques prácticamente intactos existentes en esta zona.

QUÉ PASA

Medioambiente

Roble

LT

LO ÚLTIMO

REVISA NUESTRA PORTADA

Revisa las noticias de último minuto

COMPARTIR

Este tesoro natural de 408 hectáreas, ubicado a apenas 12 kilómetros al noroeste de Temuco, en la Región de la Araucanía, representa además al **último remanente del bosque nativo** original del valle central en la zona sur.

publicidad

Variedad y calidad en Sodimac

Sodimac Homecenter Temuco-Cautín

publicidad



Rucamanque: Ecological conservation area

<https://www.youtube.com/watch?v=RuQzZMv97e0>

Pronóstico : Clima

emol

Tecnología

Adison Altamirano

Unir cuenta

Santiago: Viernes 26 de mayo del 2023 | Actualizado 16:23

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Parque Ecológico Rucamanque en La Araucanía: El laboratorio natural que resguarda los robles más altos y antiguos del mundo

Investigadores de la Universidad de La Frontera son los encargados de administrar el espacio de 408 hectáreas, que es el último remanente del bosque nativo original del valle central en la zona sur.

08 de Marzo de 2023 | 14:34 | Redactado por F.Fernández



Parque Ecológico y Cultural Rucamanque

Universidad de La Frontera

Casi cinco siglos tienen los robles de la especie *Nothofagus obliqua* más antiguos del bosque de Rucamanque, en la región de La Araucanía, los que datan incluso desde antes de que se produjera el encuentro de las comunidades mapuches con los colonizadores españoles. Estos ejemplares no solo corresponden a los más antiguos de la especie en Chile, sino también del mundo, dado que roble es una especie que ocurre únicamente en los bosques templados de Chile y Argentina.

Esto, según aseguró el Dr. **Rodrigo Vargas**, investigador de la Facultad de Ciencias Agropecuarias y Medioambiente de la Universidad de La Frontera, quien está a cargo de la administración del **Parque Ecológico y Cultural Rucamanque**. Explica que este dato ha sido corroborado por distintas investigaciones realizadas en el predio desde el año 2006.

NOTICIA RELACIONADA



Biólogo advierte sobre la disminución en la

"Dentro de los estudios que se han realizado en el país, incluyendo uno de la Universidad de Chile que caracterizó los ejemplares más

EL COMENTARISTA OPINA

Sobre problemas difíciles y lanzarlos al espacio

5

0

Cesar Fuentes

¿Cómo puedo ser parte del Comentarista Opina?

CRÓNICA CONSTITUCIONAL



Tratados internacionales y libertad de elección surgen como temas controvertidos



José Ignacio Martínez: "Los comisionados han entendido que las constituciones no son programas políticos"



Columna de Carlos Peña: El deber de las mayorías y las minorías

Experimental land area at UFRO

Open Access Article

Tree Cover Species Modify the Diversity of Rhizosphere-Associated Microorganisms in *Nothofagus obliqua* (Mirb.) Oerst Temperate Forests in South-Central Chile

by  Leonardo Almonacid-Muñoz ^{1,*} ,  Hector Herrera ¹   Andres Fuentes-Ramírez ^{2,3} ,  Rodrigo Vargas-Gaete ^{2,3} ,  Giovanni Larama ^{4,5}   Ronald Jara ⁶ ,  Camila Fernández-Urrutia ⁷   and  Rafael Borges da Silva Valadares ⁸  

- ¹ Departamento de Ciencias Forestales, Facultad de Ciencias Agropecuarias y Forestales, Universidad de La Frontera, Casilla 54-D, Francisco Salazar 01145, Temuco 4811230, Chile
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(This article belongs to the Section Forest Biodiversity)

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GAYANA BOTANICA

Gayana Bot. (2021) vol. 78, No. 1, 104-111

SHORT COMMUNICATION

Estudio preliminar de líquenes del orden Peltigerales presentes en el Parque Ecológico y Cultural Rucamanque, Región de La Araucanía, Chile

Preliminary study of lichens of the order Peltigerales in the Ecological and Cultural Park Rucamanque in the Araucania Region, Chile

Johana Villagra¹, Manuel Muñoz-Muñoz¹, Patricio Nuñez³ & Angélica Casanova-Katny^{1,2,*}

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ABSTRACT

The Rucamanque Park houses some of the remnants of the Roble-Rauli-Coigüe mixed forest in Central-South Chile. Cortical lichens were monitored in Renoval and in the Original Remnant Forest of *Nothofagus obliqua* (Mirb.) Oerst. We found differences in specific richness by tree species and between the Renoval (13 species) and the Original Remnant (7 species). The variables that affect the greatest richness are discussed, suggesting that the structure of the forest may play a key factor.

INTRODUCCIÓN

Los líquenes son organismos complejos producto de la asociación simbiótica, entre un hongo (micobionte) y un organismo fotosintético (fotobionte), que bien puede ser,

por zonas sombreadas y húmedas, mientras que otras por zonas de mayor exposición, además el rango de tolerancia de estas variables microclimáticas es variable entre especies (Sporn *et al.* 2010). Así también la altura de los árboles genera cambios en la diversidad líquénica, por las diferencias en





Maqui Berry
Aristotelia chilensis



Murta Berry
Ugni molinae



Calafate Berry
Berberis microphylla

Chilean Berries with biological properties

Maqui, murta y calafate: las maravillosas propiedades de los frutos patagónicos que la ciencia está descubriendo ahora

Maqui, murta and calafate: the wonderful properties of the Patagonian fruits that science is now discovering

Mark Johanson
BBC Travel

26 mayo 2021



GETTY IMAGES

Los indígenas conocen desde hace mucho tiempo los beneficios para la salud de los frutos locales.

A study developed by Fundación Chile and GfK Adimark called "Healthy Chile III" indicates that native fruits such as maqui, murta and calafate have **superior advantages in terms of antioxidants and dietary fiber** compared to traditional berries.

<https://www.bbc.com/mundo/vert-tra-57135154>



Anti-Inflammatory Chilean Endemic Plants

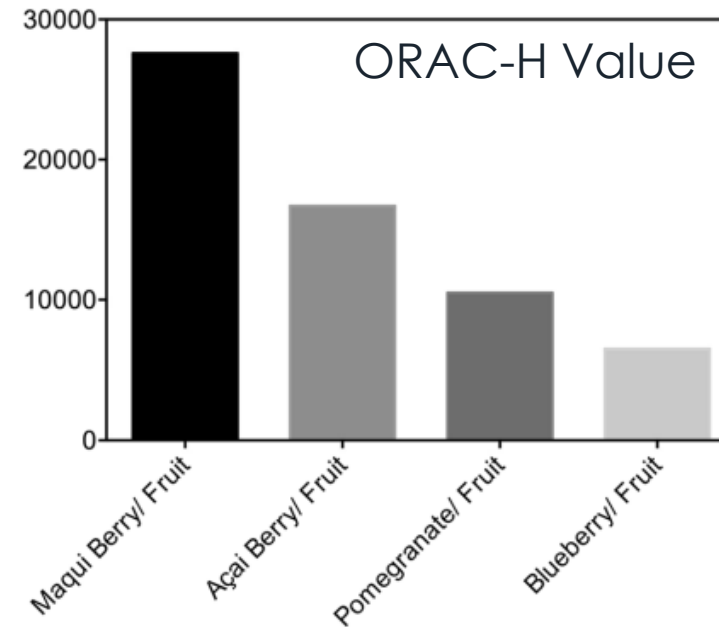
Carolina Otero ¹, Carolina Klagges ², Bernardo Morales ³, Paula Sotomayor ⁴, Jorge Escobar ^{5,*},
 Juan A. Fuentes ⁶, Adrian A. Moreno ⁷, Felipe M. Llancalahuen ⁸, Ramiro Arratia-Perez ⁹,
 Felipe Gordillo-Fuenzalida ¹⁰, Michelle Herrera ¹, Jose L. Martínez ^{11,12,13,*} and Maité Rodríguez-Díaz ^{1,*}

Table 1. Plants species and its pharmacological studies.

Plant Species	Traditional Uses	Phytochemical Bioactives	In Vitro/In Vivo Studies	Clinical Studies
<i>Ugni molinae</i> Turcz	edible fruits, pain relief, diarrhea	phenolic compounds, pentacyclic triterpene acids such as corosolic acid	[7–10]	[11]
<i>Buddleja globosa</i> Hoppe	healing wounds, dysentery, stomach ulcers, scabies, syphilis	saponins, sesquiterpenes, triterpenes, diterpenes, phenylethanoids, flavonoids	[12–14]	NR
<i>Schinus polygamus</i> (Cav.) Cabrera	wound cleansing, arthritis	α - and β -pinene terpenoids, essential oil	[15]	NR
<i>Berberis microphylla</i>	edible fruits, pain relief, diarrhea	polyphenols, anthocyanins	[16]	NR
<i>Aristolelia chilensis</i> (Mol.) Stuntz	astrigent and febrifuge properties, anti-diarrheal, anti-inflammatory, analgesic, anti-hemorrhagic	flavonoids, caffeic and ferulic acids	[17–22]	NR
<i>Quillaja saponaria</i> Mol.	pain relief	pentacycle triterpenoids	[23,24]	[25]
<i>Geoffroea decorticans</i>	edible fruit	sugar, fiber, and a complex mixture of polyphenols	[26–28]	NR
<i>Peumus boldus</i> Mol.	headaches, rheumatism, dyspepsia, menstrual pain, urinary tract inflammation	alkaloids, flavonoids, essential oil	[29–31]	NR
<i>Fragaria Chilensis</i> spp. <i>chiloensis</i>	edible fruit	polyphenols, anthocyanins	[32,33]	NR
<i>Eulachnia</i> ACIDA Phil	edible fruit	flavonoids	[34,35]	NR
<i>Laretia acaulis</i>	gastric stimulus, diuretics, analgesics, rheumatism, diabetes treatment	mulinane diterpenoid	[36,37]	NR
<i>Acaena magellanica</i> (Lam.) Vahl	pain, gallbladder, allergies	triterpenes and steroids	[38]	NR
<i>Haplopappus remyanus</i>	Antispasmodic, antiseptic	flavonoids and coumarins	[39]	NR



Aristotelia chilensis (Mol.) Stuntz, called Maqui, is known for its pharmacological uses in traditional medicine of native Mapuche communities in Chile.



Maqui is an endemic species of the sub-Antarctic forests of Chile

The **high content of polyphenols** allows the use of Maqui in preparing functional food or nutraceuticals and can reduce the use of artificial additives antioxidants.



Hydroethanolic Extracts of the *Aristotelia chilensis* (Maqui) Berry Reduces Cellular Viability and Invasiveness in the Endometrial Cancer Cell Line Ishikawa

Integrative Cancer Therapies
Volume 20: 1–10
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SAGE

Javier Mena, PhD¹, Estefanía Elgueta, PhD¹, Francisca Espinola-Gonzales¹, Hugo Cardenas, PhD¹, and Pedro A. Orihuela, PhD^{1,2}

Abstract

Cancer of the reproductive tract includes diseases with higher prevalence in the female population. This investigation examined whether an anthocyanin-enriched extract of *Aristotelia chilensis*, commonly known as “maqui,” could affect



Journal of Ethnopharmacology

Volume 241, 15 September 2019, 111979



Review

Patagonian berries as native food and medicine

Guillermo Schmeda-Hirschmann^{a, b}, Felipe Jiménez-Aspee^c, Cristina Theoduloz^d, Ana Ladio^e

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<https://doi.org/10.1016/j.jep.2019.111979>

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molecules



Review

A Comprehensive Literature Review on Cardioprotective Effects of Bioactive Compounds Present in Fruits of *Aristotelia chilensis* Stuntz (Maqui)

Lyanne Rodríguez^{1,†}, Andrés Trostchansky^{2,†}, Hermine Vogel³, Irene Wood², Iván Palomo¹, Sergio Wehinger^{1,*} and Eduardo Fuentes^{1,*}

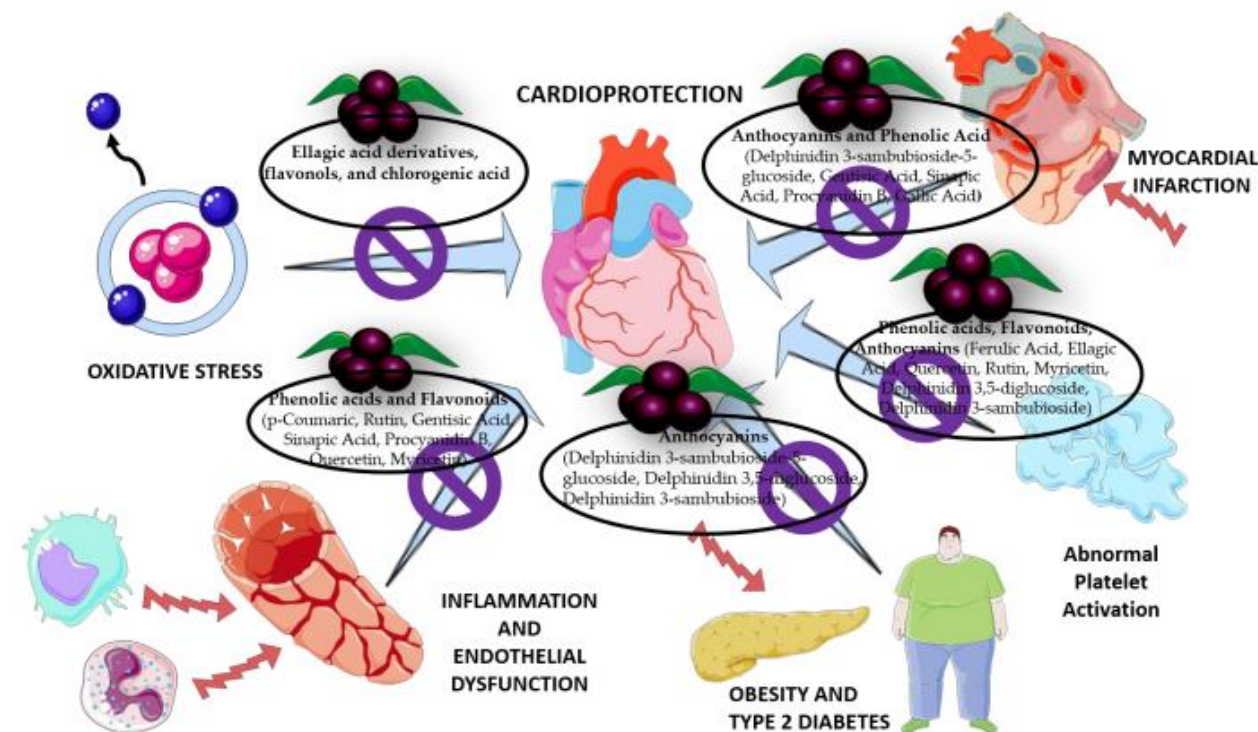


Figure 4. Cardioprotective effect of chemical compounds identified in Maqui.



Chilean berry *Ugni molinae* Turcz.

Murta leaves extracts showed the highest phenolic content and antioxidant activities.

Ugni molinae Turcz, also known as “Murtilla”

- Is a plant that grows in the south of Chile.
- Infusions of its leaves have long been used in traditional native herbal medicine.
- The chemical composition of the leaves indicates the **presence of polyphenols, which have antioxidant properties.**



Food Research International

Volume 102, December 2017, Pages 119-128



Chilean berry *Ugni molinae* Turcz. fruit and leaves extracts with interesting antioxidant, antimicrobial and tyrosinase inhibitory properties

Carol López de Dicastillo^a , Fernanda Bustos^a, Ximena Valenzuela^a,
Gracia López-Carballo^b, Jose M. Vilariño^c, Maria Jose Galotto^a



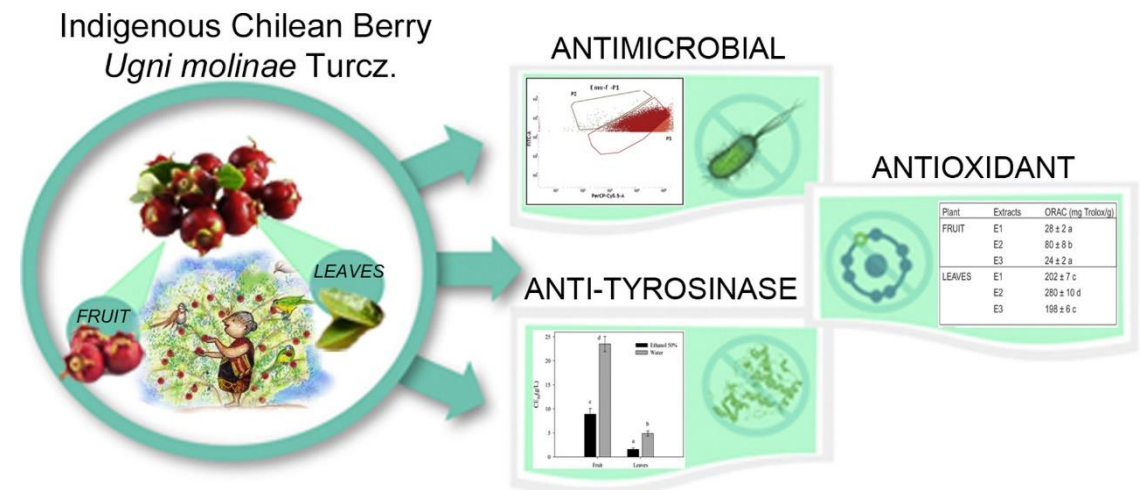
Food and Chemical Toxicology

Volume 45, Issue 1, January 2007, Pages 130-135



Protective effect of *Ugni molinae* Turcz against oxidative damage of human erythrocytes

M. Suwalsky^a , P. Orellana^{a b}, M. Avello^b, F. Villena^c

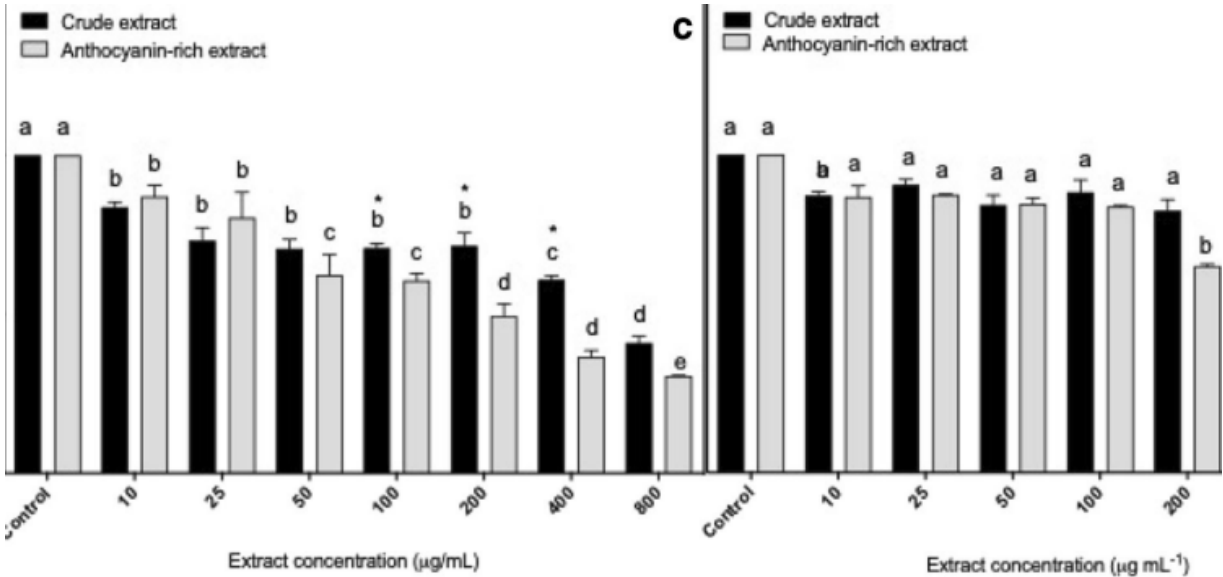
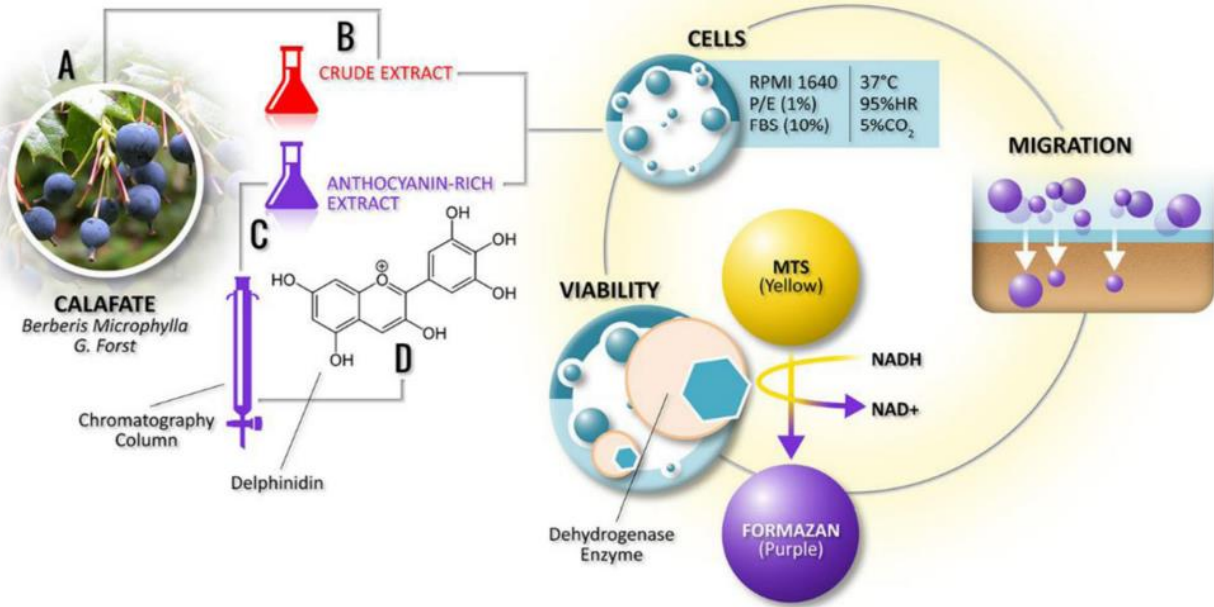




Anthocyanin-Rich Extracts of Calafate (*Berberis microphylla* G. Forst.) Fruits Decrease In Vitro Viability and Migration of Human Gastric and Gallbladder Cancer Cell Lines

Cristóbal Calderón-Reyes^{1,2} · Ramón Silva Pezoa³ · Pamela Leal⁴ · Alejandra Ribera-Fonseca^{5,6} · Cristina Cáceres^{1,6} · Ismael Riquelme³ · Tomas Zambrano⁷ · Daniela Peña² · Miren Alberdi^{6,8} · Marjorie Reyes-Díaz^{6,8}

Received: 25 January 2020 / Accepted: 3 May 2020 / Published online: 19 May 2020
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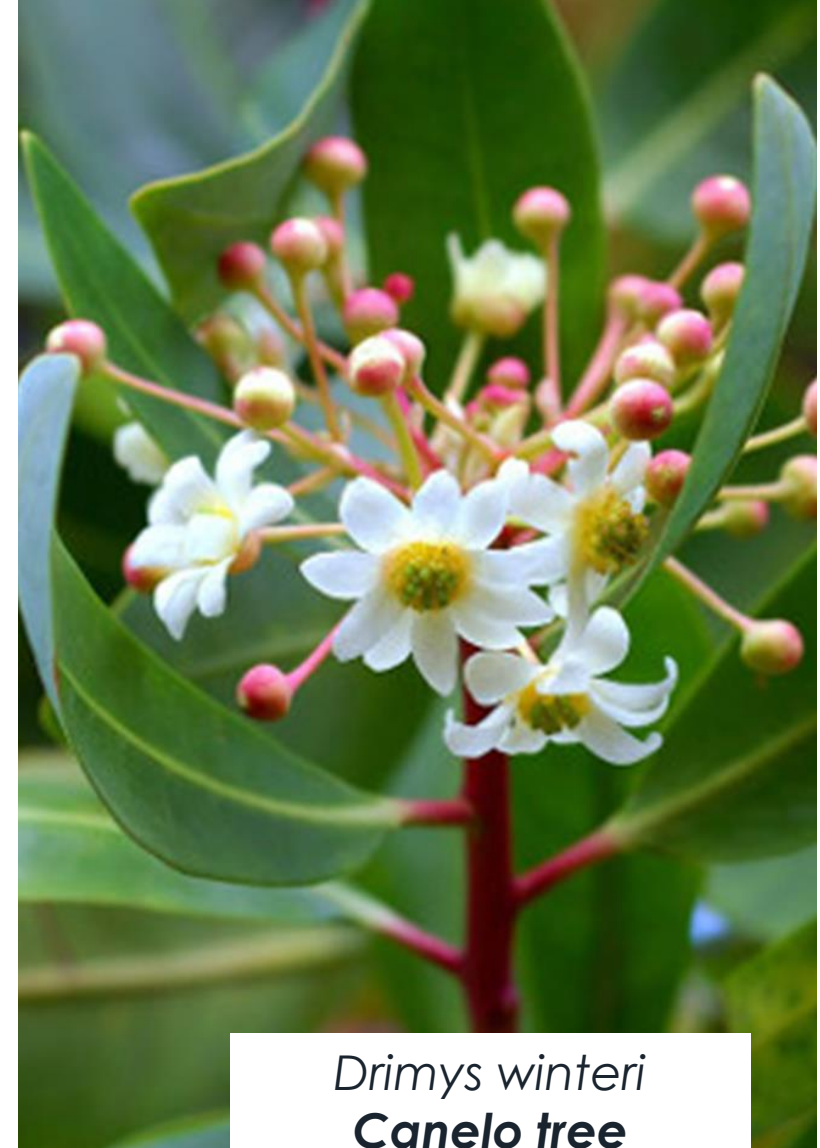
Exploring the potential of other natural trees for medicinal applications.



Gevuina avellana
Chilean hazelnut



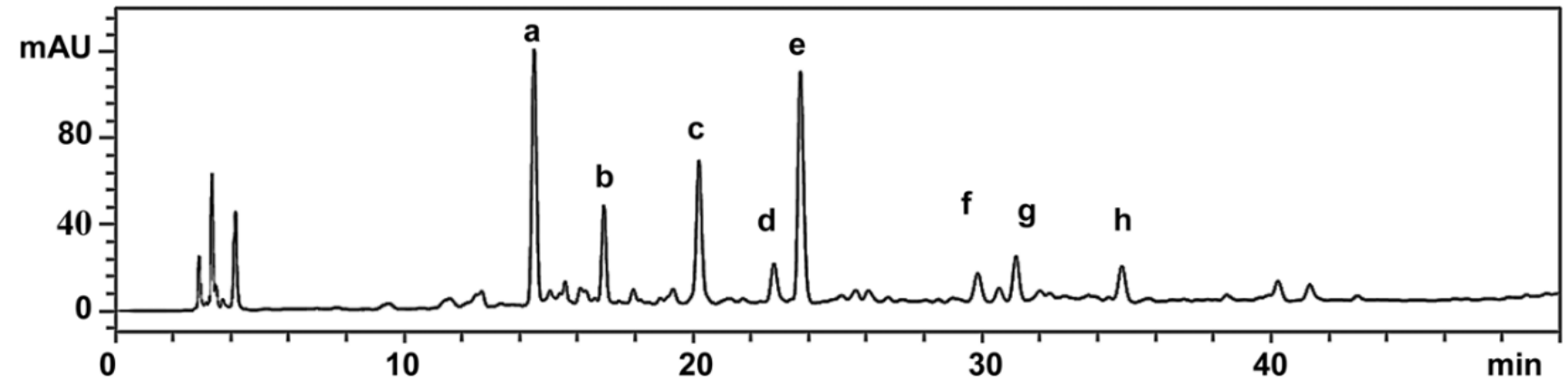
Prumnopitys andina
Lleuque tree



Drimys winteri
Canelo tree



Chilean hazel scientifically known as *Gevuina avellana* is an evergreen tree or large shrub that belongs to a mono specific genus of the **family Proteaceae**. The plant is **native to southern Chile** and adjacent valleys in Argentina.



HPLC-DAD chromatogram of the PEE from Chilean hazelnuts. Compounds.

- caffeic acid hexoside
- hydroxymethylfurfural
- main compound: tryptophan
- phenyl caffeate
- cyclo (Arg-Trp)
- hydroxybenzoic acid
- sinapic acid hexoside
- benzoic acid

Small peptides in *G. avellana* adds evidence on the possible beneficial effects of this nut in human health.





OPEN

SCIENTIFIC REPORTS

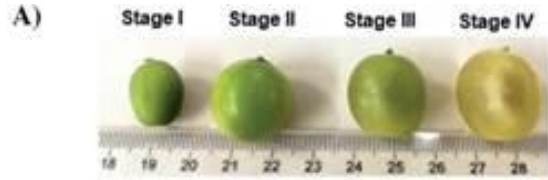
nature research



A cyclic dipeptide from the Chilean hazelnut cotyledons (*Gevuina avellana* Mol., Proteaceae)

Guillermo Schmeda-Hirschmann¹✉, Jean Paulo de Andrade^{1,2}, Felipe Jiménez-Aspee^{3,4} & Daniel Mieres-Castro¹

The Chilean hazelnut (*Gevuina avellana* Mol., Proteaceae) is a southern South American nut consumed as a snack and included in different preparations of traditional Chilean cuisine. Recently we described the fatty acid profile, oxylipins, phenolic compounds, as well as the antioxidant capacity. The main compounds of the phenolic-enriched extract were only tentatively identified by spectrometric means. In the present work, we describe the isolation and full characterization of a cyclic dipeptide cyclo(Arg-Trp) and other compounds from the phenolic enriched extracts of the *G. avellana* cotyledons. Compounds were isolated by means of counter-current chromatography and structures were established by spectroscopic and spectrometric methods. This is the first report on small peptides in *G. avellana* and adds evidence on the possible beneficial effects of this nut in human health.



RESEARCH

Phytochemical characterization and antioxidant properties of *Prumnopitys andina* fruits in different ripening stages in southern Chile

Claudio Inostroza-Blancheteau¹, Yoselin Sandoval¹, Marjorie Reyes-Díaz², Ricardo Tighe-Neira¹, and Jorge González-Villagra^{1*}

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Food and Chemical Toxicology

journal homepage: www.elsevier.com/locate/foodchemtox



Drimys winteri and isodrimeninol decreased foam cell formation in THP-1 derived macrophages

Viviana Burgos^a, Cristian Paz^b, Kathleen Saavedra^{a,b}, Nicolás Saavedra^{a,b}, Mary Ann Foglio^c, Iván González-Chavarría^d, Luis A. Salazar^{a,b,*}

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***Drimys winteri* J.R. Forst. & G. Forst** [Winteraceae] is a native tree of Chile, considered sacred by the originary people of Chile Mapuche, due to its medicinal properties.

Collaboration networks



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Many thanks for your attention!

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Landscape Ecology and Conservation Lab