Wallonie - Bruxelles International.be
Délégation Santiago du Chili

CONICYT
Ministerio de Educación
Gobierno de Chile

"Building International Cooperation on Arid Zones Research "

"Valorization of native flora of Chile: a way to innovate in agribusiness"

Lida Fuentes Viveros
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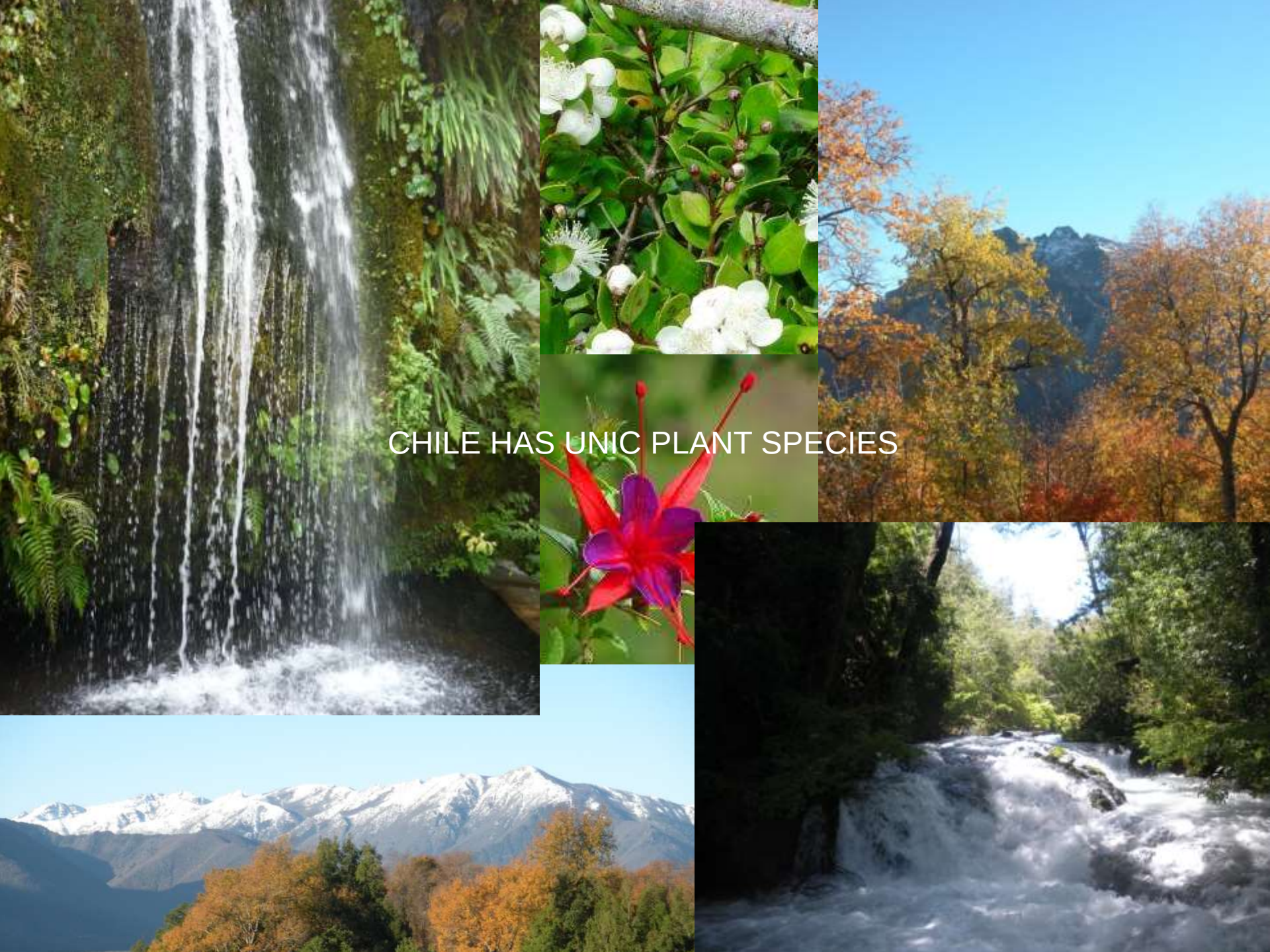
Centro Regional de Estudio en Alimentos y Salud CREAS-Sede INIA La Cruz
www.creas.cl

Santiago, 17 de noviembre 2014

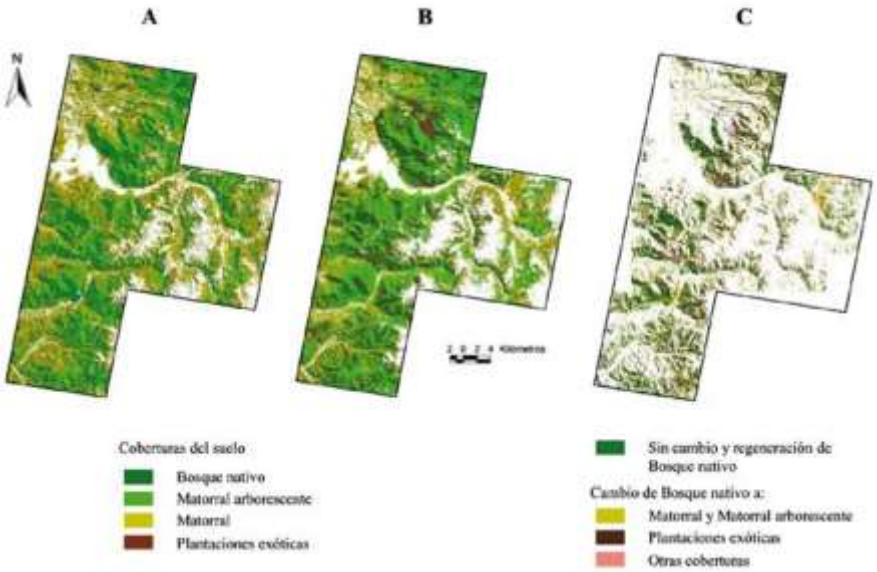
INIA

CREAS
Centro Regional de Estudios en Alimentos y Salud


CHILE HAS UNIC PLANT SPECIES

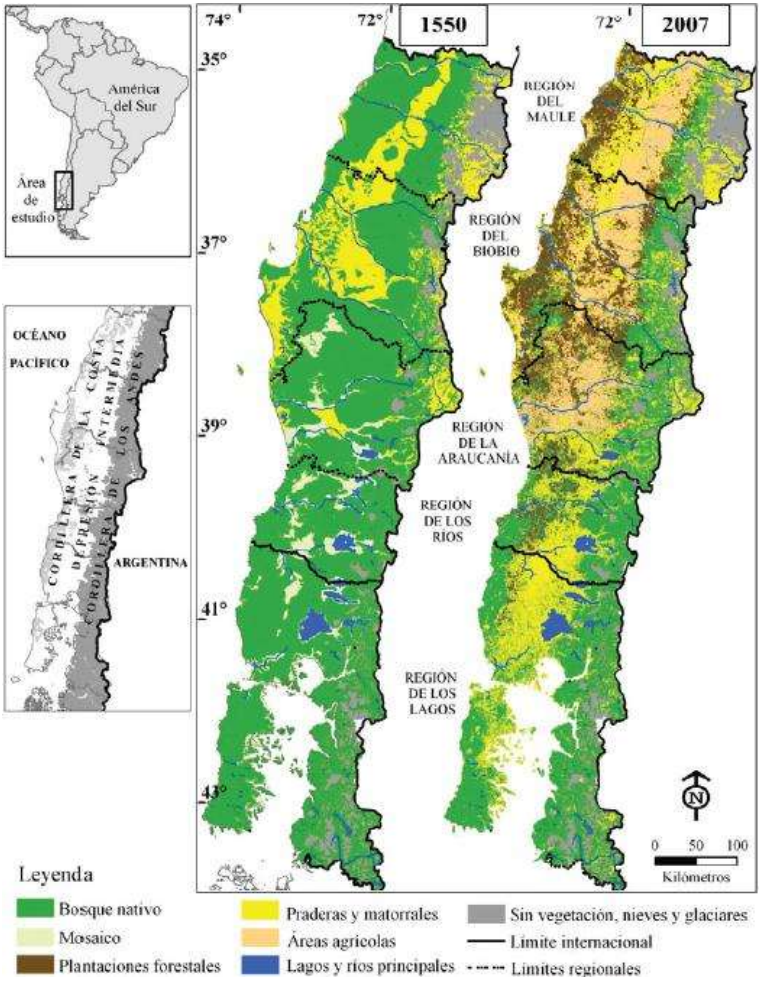
LOST OF NATIVE FLORA

Central Region



Adison Altamirano y Antonio Lara et al, BOSQUE 31(1): 53-64, 2010

South Region (Valdivia)



Antonio Lara et al, BOSQUE 33(1): 13-23, 2012

TYPICAL USES

- Mapuche tradition
- Touristic place
- Garden design
- Gourmet cousin
- Pretty cut flowers
- Mapuche medicine

MEDICINE USES OF SPECIES FROM VALPARAÍSO REGION

PEUMO

BOLDO

Boldin,
antioxidants

ESPINO

CHAGUAL

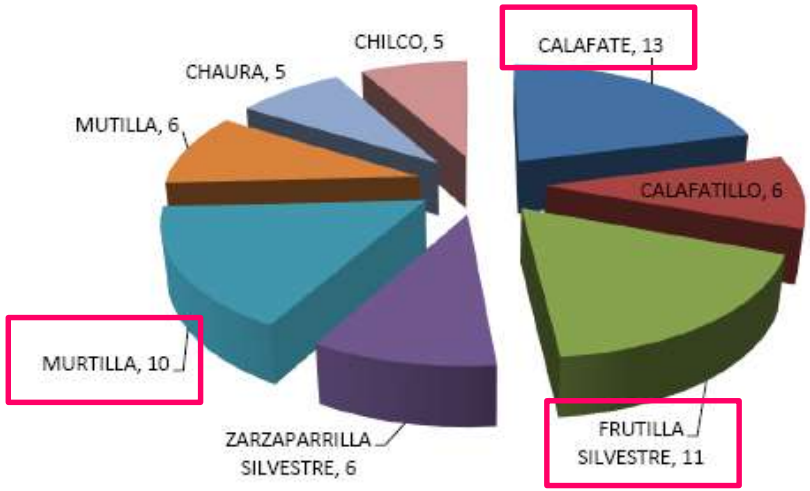
QUILLAY

saponins

ALSTROMERIA

Commercial products
Tea, extract, shampoo

PRODUCTIVE POTENTIAL OF PATAGONIC FRUIT



Juliana Torres y Colaboradores, 2010

RESEARCH OF EDIBLE FRUITS

Chilean Strawberry (*Fragaria chiloensis*)

Maqui (*Aristotelia chilensis*)

Calafate (*Berberis buxifolia*)

Antioxidant pattern

Breeding program

Healthy function

Murta (*Ugni molinae*)

Arrayan (*Luma apiculata*)

Peumo (*Cryptocarya alba*)

BREEDING PROGRAMS

▶ Variedades de murtilla: Red Pearl INIA y South Pearl INIA, registradas en Chile y en el mundo.

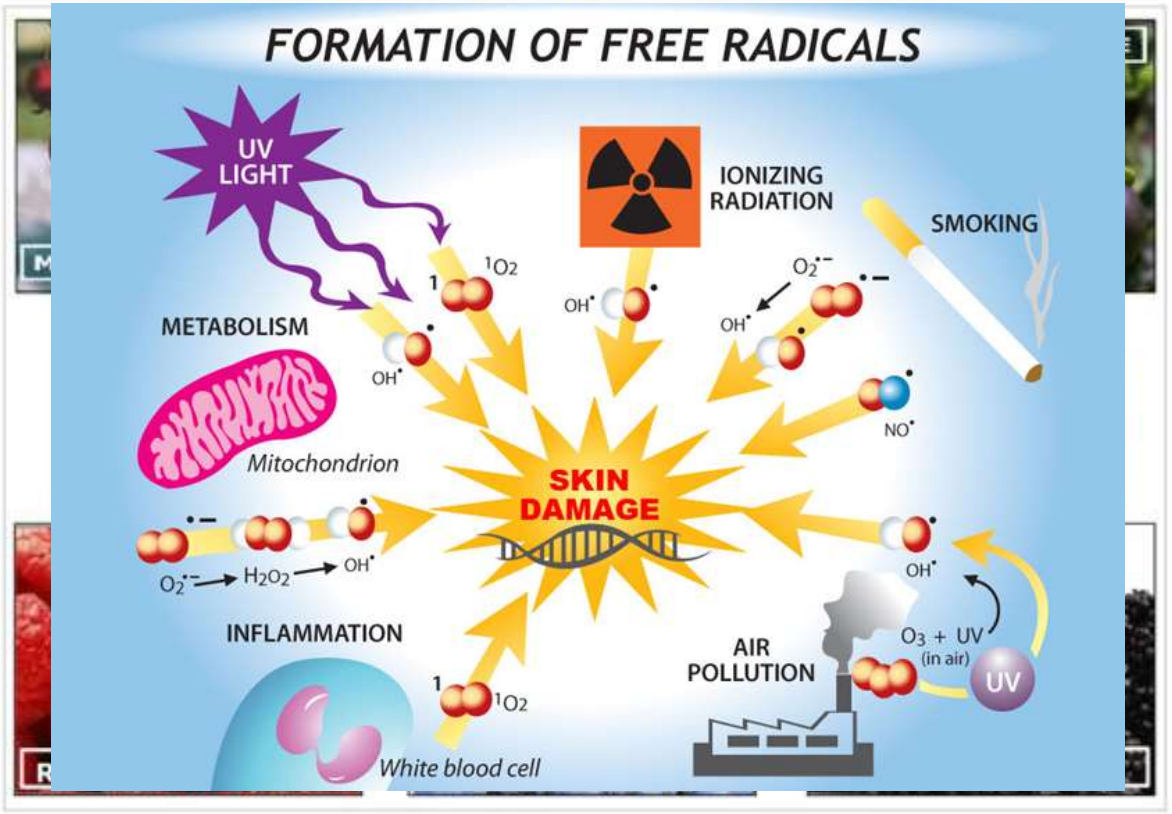
Ivette Seguel, INIA, Carillanca, TA 96, 2011

Benjamín Varas et al., **Identification and Characterization of Microsatellites from Calafate (*Berberis microphylla*, Berberidaceae)** Applications in Plant Sciences, 1(7) 2013. INIA La Platina-Concepcion University.

Proyecto FONDEF "**Screening de material genético y desarrollo de técnicas de manejo de maqui (*Aristotelia chilensis*) para mejorar la oferta de materia prima exportable y agroindustrial"** Talca university.

NATIVES FRUIT
¿SOURCE OF BIOMOLECULES?

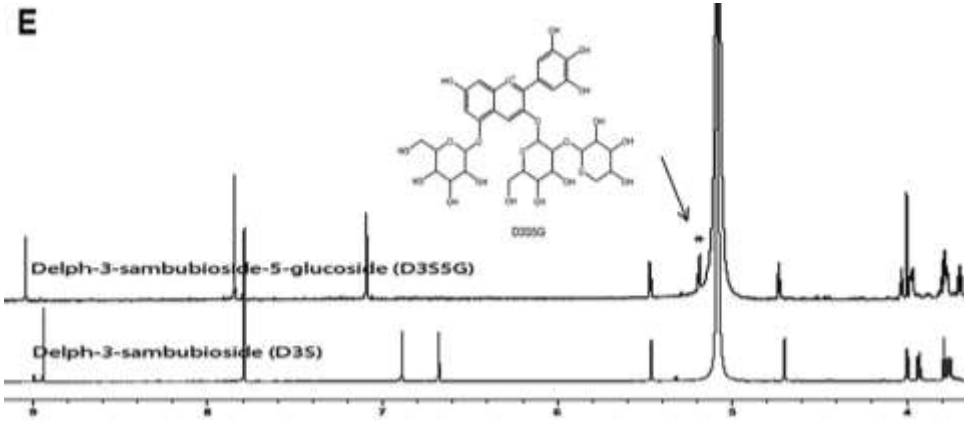
ORAC

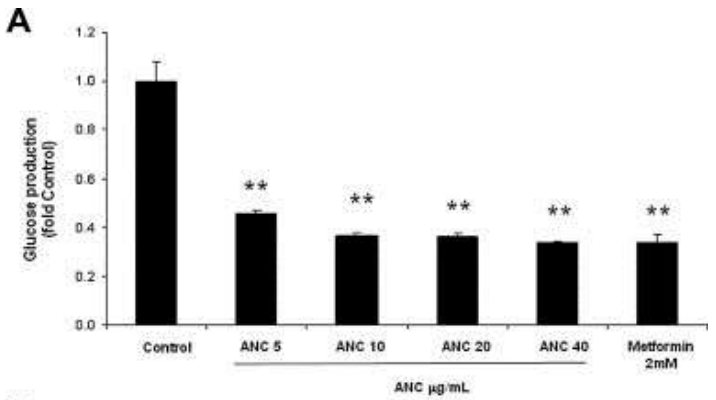


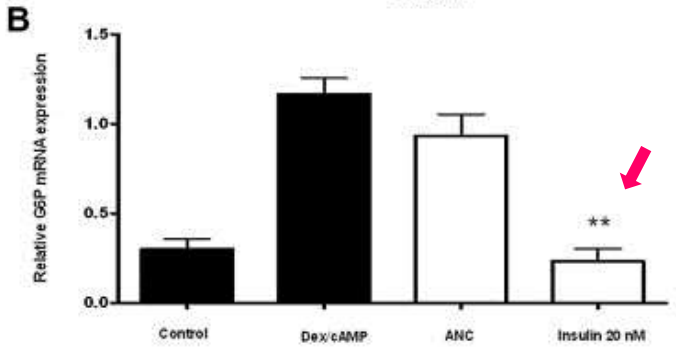
Escribano-Bailón, 2002; Miranda-Rottmann, 2002; Rubilar, 2006,Suwalsky, 2007;Fredes et al, 2009; Ruiz 2010; Shene 2012; Rojo et al, 2012

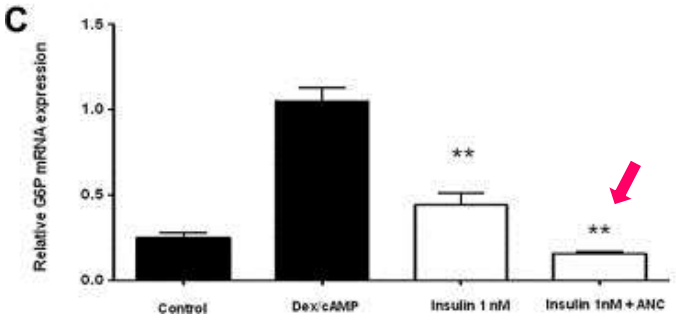
Desde Speisky et al, 2011

ACTIVIDAD ANTI-DIABETES DE ANTOCIANINAS DE MAQUI









Rojo, Leonel E., David Ribnicky, Sithes Logendra, Alex Poulev, Patricio Rojas-Silva, Peter Kuhn, Ruth Dorn, Mary H. Grace, Mary Ann Lila, Ilya Raskin. 2012. ***In vitro* and *in vivo* anti-diabetic effects of anthocyanins from Maqui Berry (*Aristotelia chilensis*).** Food Chemistry, 131: 387-396.

NUTRICOSMETIC MARKET

The wellness products are according to new consumer requirements: natural and environmental friendly products.

The nutricosmetic products are foods or ingredients related to anti-age and healthy.

The consumers are searching for new product

Functional foods -US$ 800 billions
The growth rate is increasing
Europe and Japan are principals producer

MARKET CONSIDERATION FOR COMERCIALIZABLE PRODUCT

Competitively

Wellness market: Big number of patent related to antioxidant. There are few product, one is green tea, with real functional properties.

Business model:

Harvest type, specie availability and recollection center has been contemplated

Agree value such as “bioactive molecules” “Real healthy potential” “economical and social development” are key for a good marketing.

Antioxidant pattern

Breeding program or green house availability

Healthy function

NATIVES FRUIT ON NUTRICOSMETIC MARKET

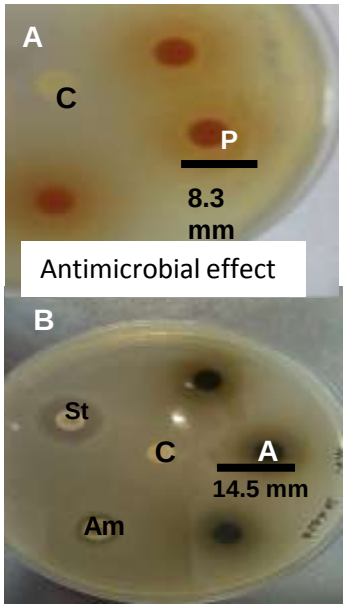
Anti-age juice

Pills and powder for diabetes and high cholesterol treatment

Anti-age cream

Antimicrobial activity of arrayan and peumo

	Antioxidant capacity			
	Polyphenols [gAG/100g]	FRAP [mM $FeSO_4$]	TEAC [Eq.Trolox/100gFW]	DPPH [µM]
Arrayan	83.64±3.26	23.81±1.50	18.00±2.10	19.16±0.60
Peumo	51.69±2.43	9.85±0.38	9.46±1.12	14.38±0.48
Blueberry	48.86±1.60	10.23±2.45	9.94±2.27	17.36±0.83



Food safety

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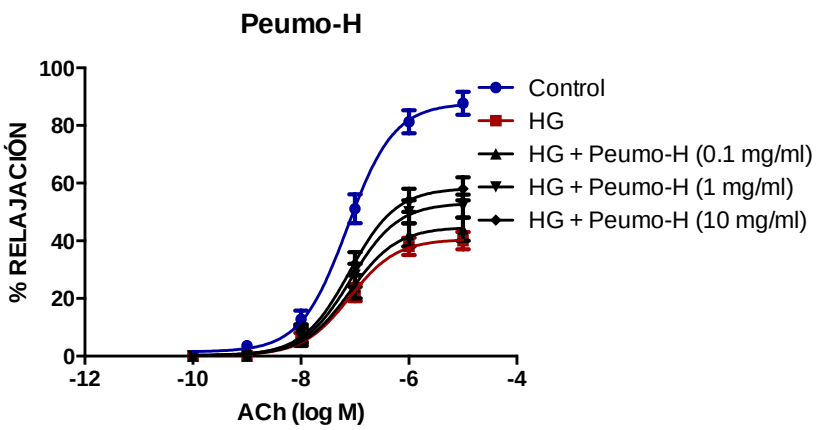
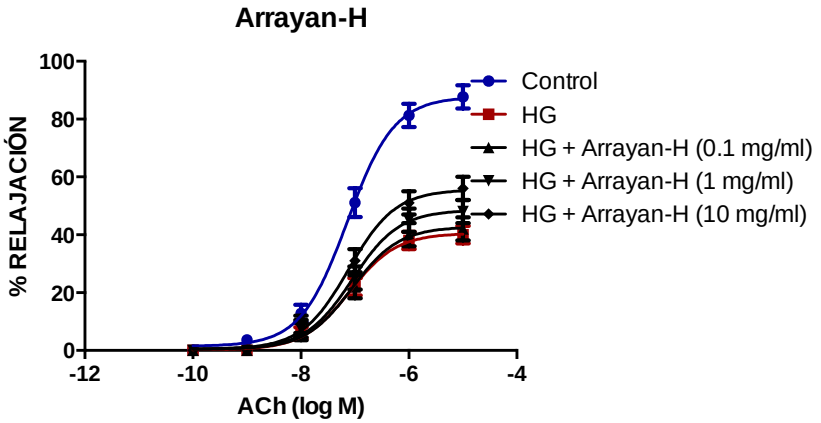
Franco et al, submitted to Journal o food protection

VASCULAR PROTECION OF PEUMO AND ARRAYAN

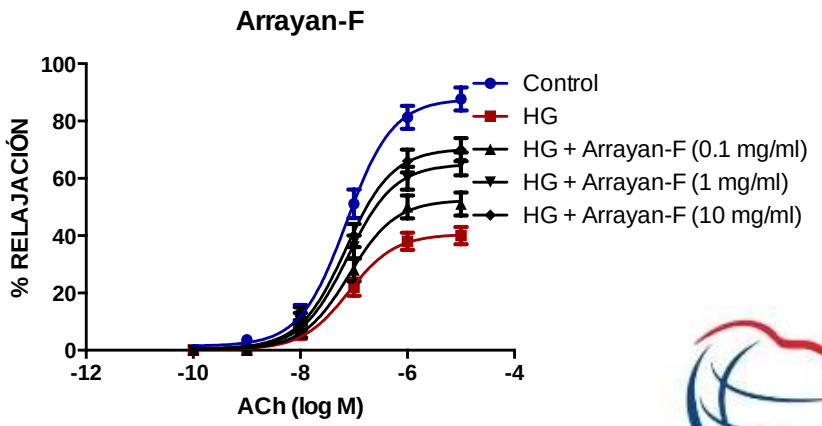
A



B



C



HG: High glucose
Ach: acetylcholine

Fuentes et al, manuscripts unpuplished (Food chemistry)

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Quinoa (*Chenopodium quinoa*)

Bolivia

Water

Protein

Protein:12 -20 %
Vitamin: B y E
Minerals: Ca, Zn, Li
Phytoestrogens

Ingredient for advance nutrition
Gluten free

Saponin removing

Bread

INIA, PUC

Pro-biotic preservation using fructo-oligosacarides biosinthesis from sugars of black algarrobo

Black algarrobo (*Prosopis nigra)*
Tree of Gran Chaco Region (Argentina), Bolivia, Paraguay and Uruguay.
Edible vain

Andrea Gómez-Zavaglia PhD (Argentina), María Elvira Zuñiga-Hansen PhD (Chile)
Contact: Nelson Romano (romanobiotech@gmail.com

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CONICET

Flour with high sucrose content (~50% Dw of vaina).

↓

Enzymatic sinthesis

↓

Fructo-oligosacarides
(Fru_n- Glu with prebiotic properties).

↓

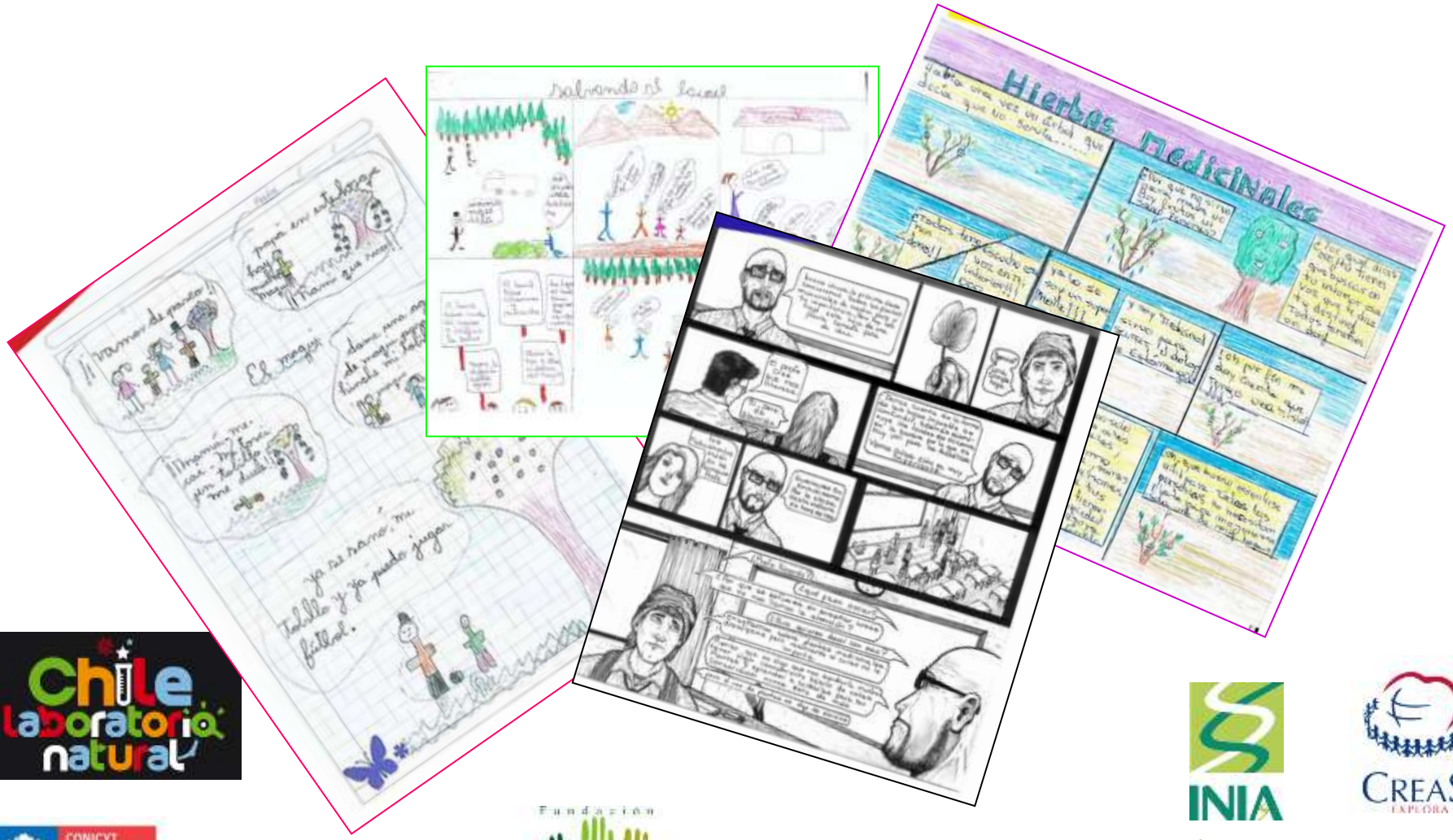
APLICATION
Protection of lactobacillus during process (liophylization, spray-dry, frozen).

Prosopis chilensis

NaCl tolerance
Goat foods
risk

In-vitro propagation, Cristian Ibañez , Universidad de la Serena

DIFFUSION ACTIVITY



Chile laboratorio natural

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ARTEQUIN Viña del Mar

PONTIFICIA UNIVERSIDAD CATOLICA DE VALPARAISO

THE BIODIVERSITY IS THE BEST FRIEND OF FOOD INNOVATION

PROYECTOS CREAS EN FLORA NATIVA

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Fondo de Investigación del Bosque Nativo

conaf
corporación nacional forestal

CORFO
sueña emprende crece

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MOLÉCULAS ANTIOXIDANTES EN FRUTOS NATIVOS

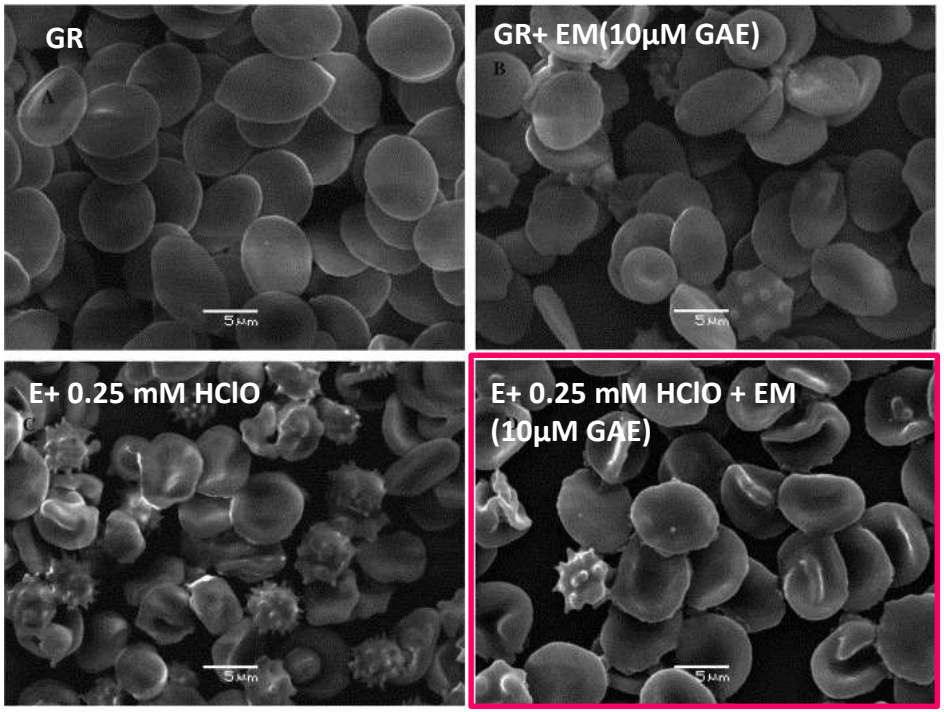
Table 4. Flavonoid Concentration, Total Phenols, and Antioxidant Activity in Calafate, Maqui, and Murtilla Berries (Fresh Weight)[a]

		anthocyanins (μmol/g of fresh wt)	flavonols (μmol/g of fresh wt)	flavan-3-ols (μmol/g of fresh wt)	total phenols IFC[b]	total phenols A_{280}[c]	antioxidant activity (Trolox equivalent, μmol/g of fresh wt)
calafate	La Junta 2007	19.63 ± 1.26	0.14 ± 0.01	0.43 ± 0.02	70 ± 7	188 ± 11	50.8 ± 12.4
	Coyhaique 2006	16.73 ± 1.08	0.13 ± 0.01	0.85 ± 0.04	110 ± 12	227 ± 13	94.7 ± 23.1
	Coyhaique 2007	26.13 ± 1.68	0.13 ± 0.01	0.61 ± 0.03	123 ± 13	278 ± 16	99.5 ± 24.3
	Faro San Isidro a 2008	14.21 ± 0.91	0.19 ± 0.01	traces[d]	70 ± 7	154 ± 9	78.0 ± 19.0
	Faro San Isidro b 2008	14.51 ± 0.93	0.21 ± 0.01	traces	79 ± 8	158 ± 9	51.3 ± 12.5
	Faro San Isidro c 2008	15.44 ± 0.99	0.14 ± 0.01	traces	75 ± 8	192 ± 11	81.2 ± 19.8
	Faro San Isidro d 2008	19.07 ± 1.23	0.12 ± 0.01	traces	84 ± 9	194 ± 11	75.9 ± 18.5
	Darwin 2008	16.76 ± 1.08	0.20 ± 0.01	traces	84 ± 9	195 ± 11	64.3 ± 15.7
	mean	17.81 ± 0.98 a	0.16 ± 0.01 a	0.24 ± 0.03 a	87 ± 9 a	198 ± 11 a	74.5 ± 15.9 a
maqui	Concepción	20.22 ± 1.30	0.11 ± 0.01	0.09 ± 0.01	113 ± 12	213 ± 10	100.5 ± 24.5
	Temuco	17.40 ± 1.12	0.11 ± 0.01	0.11 ± 0.01	75 ± 8	164 ± 8	69.9 ± 17.1
	Calafquén	16.01 ± 1.03	0.15 ± 0.01	0.12 ± 0.01	103 ± 11	276 ± 14	93.9 ± 22.9
	mean	17.88 ± 1.15 a	0.12 ± 0.01 a	0.11 ± 0.01 b	97 ± 10 a	218 ± 11 a	88.1 ± 21.5 a
murtilla	Concepción	0.20 ± 0.01	0.25 ± 0.01	0.16 ± 0.01	35 ± 4	60 ± 2	19.3 ± 4.7
	Loncoche	0.22 ± 0.01	0.32 ± 0.01	0.35 ± 0.02	27 ± 3	69 ± 3	8.6 ± 2.1
	Valdivia a	0.24 ± 0.02	0.29 ± 0.01	0.36 ± 0.02	37 ± 4	71 ± 3	10.4 ± 2.5
	Valdivia b	0.19 ± 0.01	0.28 ± 0.01	0.21 ± 0.01	27 ± 3	73 ± 3	8.4 ± 2.0
	mean	0.21 ± 1.08 b	0.29 ± 0.01 b	0.27 ± 0.01 a	32 ± 4 b	68 ± 3 b	11.7 ± 2.3 b
blueberries	Temuco	2.53 ± 0.16	0.12 ± 0.01	0.07 ± 0.01	17 ± 1	65 ± 3	14.5 ± 0.59

[a] In each column values with different letters are significantly different ($\alpha < 0.05$) obtained by ANOVA. [b] Folin−Ciocalteu method. [c] Absorbance 280 nm method. [d] Traces: detected but not quantified.

Ruiz A, Hermosín-Gutiérrez I, Mardones C, Vergara C, Herlitz E, Vega M, Dorau C, Winterhalter P, von Baer D. **Polyphenols and antioxidant activity of calafate (Berberis microphylla) fruits and other native berries from Southern Chile.** J Agric Food Chem. 2010 May 26;58(10):6081-9. doi: 10.1021/jf100173x.

EFECTO PROTECTOR DE EXTRACTO MURTA EN CELULAS SANGUINEAS



Daño celular

5-10 %

Suwalsky M, Orellana P, Avello M, Villena F. **Protective effect of Ugni molinae Turcz against oxidative damage of human erythrocytes**. Food Chem Toxicol. 2007 Jan;45(1):130-5.

CONTENIDO DE ANTOCIANINAS EN MAQUI

Table 2 Contents (expressed in equivalents of delphinidin 3-glucoside) and proposed identities of the anthocyanins detected in the berries of *Aristotelia chilensis*

Anthocyanin	Content (mg/100 g)
Delphinidin-3-sambubioside-5-glucoside	46.4 ± 0.1
Delphinidin-3,5-diglucoside	23.7 ± 0.2
Cyanidin-3-sambubioside-5-glucoside	18.7 ± 0.2
Cyanidin-3,5-diglucoside	
Delphinidin-3-sambubioside	14.2 ± 0.1
Delphinidin-3-glucoside	17.1 ± 0.2
Cyanidin-3-sambubioside	8.9 ± 0.04
Cyanidin-3-glucoside	8.6 ± 0.05
Total anthocyanins	137.6 ± 0.4

Escribano-Bailón MT, Alcalde-Eon C, Muñoz O, Rivas-Gonzalo JC, Santos-Buelga C. **Anthocyanins in berries of Maqui (*Aristotelia chilensis* (Mol.) Stuntz).** Phytochem Anal. 2006 Jan-Feb;17(1):8-14.

EFECTO DE EXTRACTO Y MURTA SOBRE ENZIMAS DIGESTIVAS

Table 2. Effect of Crude Extracts of Murta and Maqui Leaves, Fruits, and Stems and Their Aqueous Fraction (Fraction A) and Organic-Aqueous Fraction (Fraction B) on α-Amylase and α-Glucosidase Inhibition

		crude extract	fraction A	fraction B
		IC_{50} α-amylase inhibition (mg of extract/L)		
murta	leaves	79.5 ± 3.1	110.1 ± 1.9	165.0 ± 30.2
	fruits	>100	>750	>750
	stems	★ 56.6 ± 1.2	>750	*a*
maqui	leaves	>100	314.2 ± 2.9	521.5 ± 7.6
	fruits	★ 41.5 ± 3.6	>750	*a*
	stems	>100	>750	>750
		IC_{50} α-glucosidase inhibition (mg of extract/L)		
murta	leaves	★ 12.5 ± 1.8	153.0 ± 3.8	215.7 ± 6.3
	fruits	69.2 ± 5.0	457.8 ± 9.1	61.3 ± 7.0
	stems	39.1 ± 5.2	108.5 ± 1.1	*a*
maqui	leaves	6.1 ± 0.9	139.1 ± 4.7	2.4 ± 0.3
	fruits	47.9 ± 2.7	197.3 ± 4.2	*a*
	stems	★ 1.1 ± 0.1	112. 3 ±16.5	189.4 ± 27.7

[a] Insufficient amount of lyophilized sample for analysis.

Flavan-3-ol y flavonoles glicosilados (quercetina y kaenferol-glucosido).

Rubilar M, Jara C, Poo Y, Acevedo F, Gutierrez C, Sineiro J, Shene C.
Extracts of Maqui (*Aristotelia chilensis*) and Murta (*Ugni molinae* Turcz.): sources of antioxidant compounds and α-Glucosidase/α-Amylase inhibitors. J Agric Food Chem. 2011 Mar 9;59(5):1630-7. doi: 10.1021/jf103461k.