

Valeriana carnososa Sm.



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U. P. Albuquerque et al. (eds.), *Medicinal and Aromatic Plants of South America*, Medicinal and Aromatic Plants of the World 5, https://doi.org/10.1007/978-94-024-1552-0_42

Abstract *Valeriana carnosa* Sm. stands out as one of the key elements of the indigenous pharmacopoeia used in the extreme south of the American Continent. Its rhizomes and roots have been used since ancestral times in hepatic, respiratory, circulatory, urinary, digestive and anti-inflammatory remedies. They have also been used as painkillers, sedatives and for the treatment of cultural syndromes particular to Latin-American medicine such as the “*susto*” and the “*evil eye*”. The breadth of its reputed uses has led to its being known as “the plant that cures the seven illnesses”.

The crude drug is prepared from the roots and rhizomes, principally as a decoction. Several studies indicate that the principal active ingredients are valepotriates, lignans, flavonoids, tannins, phenolic acids and essential oils. Research carried out on *V. carnosa* reveals the presence of active ingredients similar to those of *V. officinalis*, a species found in many pharmacopoeias which is used as a sedative and sleep inducer. However, little conclusive evidence of efficacy can be provided for the remaining local uses. The key problem of various studies has been their emphasis on very few compounds, rather than traditional preparations. Much more research is required to evaluate the actual efficacy of preparations.

Keywords *Valeriana carnosa* · Valerianaceae · Subterranean organs · Mapuche pharmacopoeia · Ñamkulawen

1 Introduction

The roots and other subterranean organs of numerous Patagonian species have long been recognized as being of great value to rural Creole, Mapuche and Tehuelche populations both in Argentina and Chile (Ladio and Lozada 2009; Molares and Ladio 2009a; Ochoa and Ladio 2011), and also constitute an important part of many regional rites and legends (Ochoa and Ladio 2014).

From the perspectives of economic botany and ethnopharmacology, the main value of these species is based on the fact that their subterranean organs often contain starch and other carbohydrates of importance to the human diet, and also therapeutic compounds derived from plant secondary metabolism (Gurib-Fakim 2006). Amongst these species, *Valeriana carnosa* Sm. stands out as one of the principal elements in the indigenous pharmacopoeias of the southern cone of America, and its roots and rhizomes have been known and used since ancient times (Molares and Ladio 2009b). The local perception of this plant is that it has wide-ranging curative powers: “*it’s a cure-all*”. This attribute confers on the species high cultural and symbolic value for the Mapuche people, and its reputation and use has spread throughout the formal and informal medicinal herb market of Patagonian cities (Ladio 2006).

2 Taxonomic Characteristics

V. carnosa (synonym: *Valeriana magellanica* Lam.) belongs to the Valerianaceae family, which consists of 400 species and 17 genera, mainly found in the Northern Hemisphere and along the Andes mountain range. Of the approximately 250 species of Valerianaceae found in South America, 40 taxa are restricted to the Andes of Argentina and Chile (Bell et al. 2012). It has been suggested that Holartic *Valeriana* genera have been present on the South American continent for some time (>13 MY), and have exploited new niche opportunities, migrating from a temperate to a more Mediterranean-style climate (Bell et al. 2012). Most of the species are herbaceous or small shrubs with foul-smelling roots. The name of the genus stems from the Latin *valere*, “to be healthy”, a reference to the medicinal uses of its plants, particularly those associated with treating nervous conditions and hysteria (Borsini et al. in Correa 1999). Their epithet *carnosa* makes references to the consistency of the leaves (Ferreya et al. 2006).

3 Crude Drug Used

The crude drug consists of dried pieces of the roots and rhizomes, which are sold in bulk or hand packed in paper or cellophane bags for sale in drugstores and herbalist’s shops. The recommended method of use is decoction of a handful of the material, followed by ingestion of one cupful, orally, over a variable timeframe (Cuassolo 2009; Cuassolo et al. 2011). Kutschker et al. (2002) describe a dosage of a daily cupful drunk on an empty stomach for a week.

V. carnosa and other species of the Patagonian region, such as *Valeriana clarionifolia*, are known as “ñamkulawen” and are used in similar ways in traditional medicine. According to diagnostic anatomical data provided by Bach et al. (2014), *V. carnosa* showed a primary pentarch aktinostele root, pith in the secondary structure and a rhizome with anomalous structure. *V. clarionifolia*, in contrast, has also rhizome and showed a protostele as a primary root structure and a secondary structure without pith. During the maceration process, the *V. carnosa* rhizome presented cork with irregular polygonal cells with acute and obtuse angles, while in *V. clarionifolia* rectangular cork cells with right angles were observed. Starch grains are simple, spherical in *V. carnosa* and polyhedral in *V. clarionifolia*. In addition, Molares and Ladio (2012) studied cross sections of *V. carnosa* primary root and observed a well-developed periderm consisting of cells with thickened, birefringent walls, from irregular to polygonal; cells of this tissue and phloem parenchyma with essential oils in the form of droplets (Sudan IV+); cortex with large air spaces between oval cells with brown contents (Fig. 1a–c). These anatomical characteristics could be used to recognize the crude drug commercialized in the region. *V. carnosa* is not included in the Argentine Pharmacopoeia (<http://www.anmat.gov.ar>), nor does it appears on the list of toxic species not recommended for consumption.

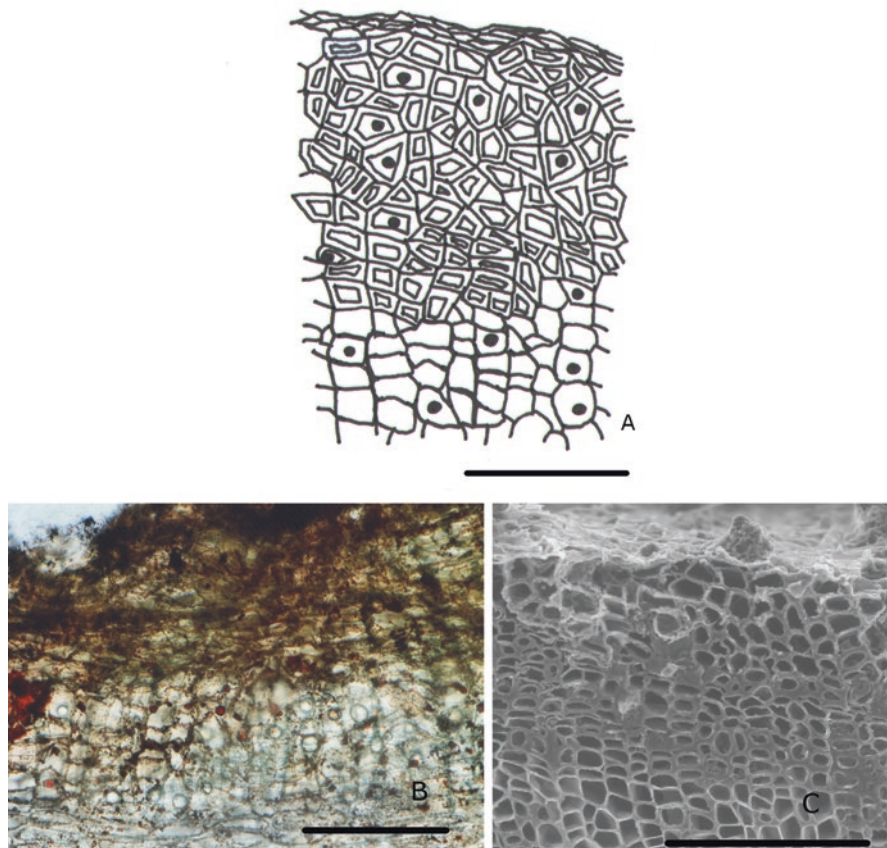


Fig. 1 Morpho-anatomy of transversal cut of primary root of *V. carnosia* Sm. (a) Diagram of a sector of the periderm and phloem parenchyma with drops of essential oils. (b) Positive reaction of Sudan IV on essential oil drops. (c) Inactive phloem and periderm viewed with an environmental scanning electron microscope. Scale in (a) 100 μm , in (b, c) 200 μm . (Taken from Molares and Ladio 2012)

4 Major Chemical Constituents and Bioactive Compounds

Several studies on the *Valeriana* genus indicate that the main active ingredients are the valepotriates, lignans, flavonoids, tannins, phenolic acids and essential oils (Kutschker et al. 2010). In particular, the essential oils have been researched; they primarily consist of elemol, bornyl-acetate, bornyl-isovalerate, isovalerate, and valerenone (Baby et al. 2005). Of all the Patagonian species belonging to this genus, the dry extract of the whole *V. carnosia* plant has been most studied (Cuadra and Fajardo 2002). It has been found that its valepotriate composition pattern, and especially its valtrates, is similar to *V. officinalis*, which is known for its tranquilizing and sleep inducing effect (Kutschker et al. 2010). However, according to Castillo

and Martínez (2007), the chemical composition of *V. carnososa* varies according to the time of collection, preparation and packaging. In addition, Cuadra and Fajardo (2002) have isolated caffeoyl methyl ester and two pinoresinol-type lignans. Fajardo et al. (2010) have also suggested that in terms of its biological activity, it would present cytotoxic activity and negative toxicological activity.

5 Morphological Description

Evergreen herb of up to 80 cm in height, simple or branching from the base. Fleshy rhizome up to 50 cm long, with weak branches. Basal leaves 6–21 × 3–7 cm, obovate or elliptic, smooth-edged or coarsely toothed, glabrous and fleshy; 3–12 cm long petioles. Upper leaves are sessile or petiolate, 0.6–4.5 cm, obovate, oblong, triangular or lanceolate, smooth-edged or toothed. Axillary or terminal inflorescences, paniculiform, lax. Bracts are 3–9 mm in length, whole, oblong-lanceolate, ovate. Bracteoles are 2.5–4 mm in length, entire or auriculate, oblong-lanceolate, acute, glabrous or have long hairs on the edges, at the base. Hermaphrodite flower: 4 mm corolla, bell-shaped or funnel and bell-shaped, gibbous at the base; oblong lobes. Included stamens. Female flower: 2–3 mm corolla, bell-shaped, ovate lobes. Exserted styles, thickened at the tip. The fruit measures 5–7 × 2–3.5 mm, and is pyriform, with thick veins, glabrous; pappus formed by 14–15 feathery setae (Borsini et al. in Correa 1999). (Figs. 2 and 3).

6 Geographical Distribution

V. carnososa is an endemic species which is widely distributed and common to the whole of Patagonia (Borsini et al. in Correa 1999). In Chile it inhabits the southern mountain range, in the VI, VII, VIII, IX, X, XI and XII regions; in Argentina it inhabits the Mendoza, Neuquén, Río Negro, Chubut, Santa Cruz and Tierra del Fuego provinces. Its altitudinal range is from 0 to 2700 m.a.s.l. (Zuloaga et al. 2008). In phytogeographic terms, it is found in the Sub-Antarctic, Patagonian and High-Andean provinces (Borsini et al. in Correa 1999).

7 Ecological Requirements

The species flourishes in xeric, open, sunny environments in the rocky soils of the forest, steppe and the Patagonian Andean forest-steppe ecotone. It is also found in sandy sites, on low, sunny slopes of the Patagonian Andes. It flowers in spring-summer (Ferreya et al. 2006).

Fig. 2 Diagram of the aerial parts of the plant (**a**), floral structures (**b, c**) and fruit (**d**) of *V. carnosa* Sm. (Taken from Borsini et al. in Correa 1999)



Fig. 3 General appearance of *V. carnosa* in a Patagonian forest-steppe ecotone habitat



8 Collection Practice

Gathering carried out by the settlers is characterized by the search for specimens in stony areas with a high level of light exposure, preferably at the highest altitude possible, with the help of simple tools like knives and spades. In the process of identification and selection of specimens, cultural practices of sensory perception come into play. These include the recognition of organoleptic qualities directly associated with this species, such as its bitter and unpleasant smell (“like dirty feet”) and its strong, bitter, repulsive flavor (“füre”), which is rather spicy (“trapi”) and astringent (“seco”) (Molares and Ladio 2009a). Various studies indicate that the collection of this species is associated with the care of livestock. The people take advantage of the time during which their animals are grazing to look for the plant in places far from their dwellings (Estomba et al. 2006; Richeri et al. 2013). With regard to the identification and collection of *V. carnosa* and *V. clarionifolia* by Patagonian inhabitants, studies reveal levels of organoleptic differentiation between the two species, which are of great cultural and ethnopharmacological value. For example, it was discovered that locals are capable of differentiating between *Valeriana* species, and that even though they recognize them as related (which can be deduced by the fact that both have the same common name), they can tell them apart by their smell and taste, which consequently determine their different uses and value (Molares and Ladio 2012). Unlike *V. carnosa*, *V. clarionifolia* is used for a limited number of ailments, mainly to relieve lower back pain and treat kidney and bladder disorders and cultural syndromes. In a curiously similar way, by means of laboratory tests with electronic noses, differences have been found between the aromatic profiles of *V. carnosa* and *V. clarionifolia*, which are determined by the chemical differences between the species (Baby et al. 2005).

The collected pieces of *V. carnosa* are usually taken to the dwellings where they are dried in the open air and in the shade, undercover, to be preserved later in mesh or paper bags. This practice ensures availability of the dried resource all year round, and is particularly useful in winter when the search for medicinal herbs in the mountains can become difficult due to the accumulation of snow (Molares and Ladio 2012).

Although *V. carnosa* gathering is very important and its commercialization has increased rapidly over the last decades (Cuassolo 2009), this species can be regarded as not threatened. However, settlers say that it is increasingly difficult to find plants, and that longer distances must be travelled in the search for them (Estomba et al. 2005, 2006). For this reason, the study of this plant's cultivation requirements must be encouraged (Cuassolo 2009).

9 Traditional Use (Part(s) Used) and Common Knowledge

V. carnosa has long been reported as “Ñamkulawen”, in the Mapuzungun language, (“White hawk medicine” in English), probably in reference to the high sites where the species grows and where the ñamku can be seen in flight. This local name (Ñamkulawen) is shared with *V. clarionifolia* Phil. but this plant has different reputed attributes, as explained above. Another local name is “Valeriana”, which is used by both Creole and rural settlers (in Spanish).

The root has been cited as a remedy used for hepatic, respiratory, circulatory, urinary and digestive disorders as well as having analgesic, anti-inflammatory, anti-tumoral, anti-depressive and wound-healing properties (e.g. Martinez Crovetto 1980; Estomba et al. 2005, 2006; Molares and Ladio 2009a, b, 2012; Richeri et al. 2013). It has also gained great prestige for its usefulness in treating cultural syndromes like the “*susto*”, “*evil eye*” and “*frío*” (Molares 2010). *V. carnosa* is also used in mixtures with other species, like “nalka” (*Gunnera tinctoria* (Molina) Mirb.) to strengthen its medicinal attributes (Molares 2010), or with “carqueja” (*Baccharis sagittalis* (Less.) DC.) and “palo piche” (*Fabiana imbricata* Ruiz et Pav.) to make “body cleansers” (Toledo and Kutschker 2012), which are used in a process which is both symbolic and practical, where the wellbeing of the person is sought by eliminating all the elements (physical, social and spiritual) which may be causing harm (Molares 2010). All these properties, grouped in seven ethnocategories according to the particular precepts of the Mapuche culture, have led to the plant also being recognized as “the remedy that cures the seven diseases” (Molares and Ladio 2012).

The local indigenous communities use the plant through decoction. They boil a piece of root, approximately 3 cm in length per liter of water, and then drink a cup each day until the liter is finished. According to our sources, perception of the strong bitter taste of this decoction is an indicator of high therapeutic effectiveness, but also of potential danger, and because of this it is only consumed by adults and the dosages

used are highly controlled and sporadic (Molares and Ladio 2009a). Traditionally, its use is not recommended for children or pregnant women (Kutschker et al. 2002). In addition, the dosage must be small because it causes sleepiness (Weigandt et al. 2004) and an excessive dosage can even be fatal (Molares and Ladio 2009a).

10 Modern Medicine Based on Its Traditional Medicinal Uses

Research carried out on *V. carnosa* and *V. clarionifolia* reveals the presence of active ingredients similar to those of *V. officinalis*, which is present in many pharmacopoeias for oral consumption as a sedative and sleep inducer for humans (Gratti et al. 2010). Kutschker et al. (2002) describe uses of the plant in modern medicine which are based on traditional methods, such as the preparation of tinctures using the steeped roots. The roots are placed in a jar with 300 ml of alcohol, left for 15 days and then filtered. The recommended dosage is 1–2 ml as a sedative.

11 Conclusions

V. carnosa is one of the most prominent medicinal plants in the Mapuche tradition, and from an ethnopharmacological viewpoint, one of the most versatile medicinal plants in Patagonia, when taking into account the wide range of therapeutic alternatives it can offer for the treatment of the different ailments of the region (Richeri et al. 2013).

The similarity between the active compounds found in *V. carnosa* and *V. clarionifolia* and those of *V. officinalis* is promising since this species is included worldwide in many pharmacopoeias and consumed orally as a sedative and sleep inducer in humans. However, little conclusive evidence for the efficacy of the other local uses can be provided. The key problem of various investigations has been an emphasis on very few compounds, rather than traditional preparations. Much more research is required to evaluate the actual efficacy of the preparations. The scientific research and cultural revalorization of the role played by *V. carnosa* in local herbal medicines is of considerable ethnopharmacological interest, and highly relevant to the medicinal security of Patagonian communities. However, there is evidence to indicate that the abundance of this species in natural environments is decreasing, mainly due to disturbance of the environments (Estomba et al. 2006; Ladio et al. 2007) and lack of regulation of its commercialization in Patagonian cities (Cuassolo 2009). Given that the roots are the organs of medical interest in this valuable species, the establishment of conservation strategies in situ and studies that provide guidelines for its cultivation and preservation ex-situ are of the utmost importance.

References

- Baby RE, Cabezas M, Kutschker A, Messina, Walsøe de Reca NE (2005) Discrimination of different valerian types with an electronic nose. *J Argentinean Chem Soc* 93(1–3):43–50
- Bach HG, Varela BG, Fortunato RH, Wagner ML (2014) Pharmacobotany of two *Valeriana* species (Valerianaceae) of Argentinian Patagonia known as “Ñancoлахуен”. *Lat Am J Pharm* 33(6):891–896
- Bell CD, Kutschker A, Arroyo MTK (2012) Phylogeny and diversification of Valerianaceae (Dipsacales) in the southern Andes. *Mol Phylogenet Evol* 63(3):724–737. <https://doi.org/10.1016/j.ympev.2012.02.015>
- Borsini OE, Rossow RA, Correa MN (1999) Valerianaceae. In: Correa MN (ed) Parte VI. Dicotyledones Gamopetalas. Flora Patagónica. INTA, Buenos Aires, pp 449–468
- Castillo García E, Martínez Solís I (2007) Manual de Fitoterapia. Elsevier, España., 536 pp
- Cuadra P, Fajardo V (2002) A new lignan from the Patagonian Valeriana carnososa Sm. *Bol Soc Chil Quimica* 47(4):361–366
- Cuassolo F (2009) Estudio Etnobotánico de las plantas medicinales nativas y exóticas comercializadas en la Ciudad de Bariloche. Universidad Nacional del Comahue, Patagonia
- Cuassolo F, Ladio AH, Ezcurra C (2011) Aspectos de la comercialización y control de calidad de las plantas medicinales más vendidas en una comunidad urbana del NO de la Patagonia Argentina Aspects. *Bol Latinoam Caribe Plant Med Aromat* 9(3):166–176
- Estomba D, Ladio AH, Lozada M (2005) Plantas medicinales utilizadas por una comunidad Mapuche en las cercanías de Junín de los Andes, Neuquén. *Bol Latinoam Plant Med Aromat* 4(6):107–112
- Estomba D, Ladio AH, Lozada M (2006) Medicinal wild plant knowledge and gathering patterns in a Mapuche community from North-western Patagonia. *J Ethnopharmacol* 103:109–119. <https://doi.org/10.1016/j.jep.2005.07.015>
- Fajardo V, Gallardo A, Araya M, Joseph-Nathan P, Oyarzún A, Cuadra P, Sanhueza V, Manosalva L, Villarroel L, Darias J (2010) Químicas y algunos antecedentes y ensayos simples de la actividad biológica de plantas de la zona austral de Chile. *Dominguezia* 26(2.) – 2010):40–21
- Ferreira M, Ezcurra C, Clayton S (2006) Flores de alta montaña de los Andes patagónicos. Editorial L.O.L.A, Buenos Aires
- Gratti A, Beeskow A, Fernández S (2010) El género *Valeriana* en la estepa patagónica argentina. Aportes al conocimiento fitoquímico. *Dominguezia* 26(2.) – 2010):55–56
- Gurib-Fakim A (2006) Medicinal plants: traditions of yesterday and drugs of tomorrow. *Mol Asp Med* 27(1):1–93. <https://doi.org/10.1016/j.mam.2005.07.008> <http://www.anmat.gov.ar/webanmat/fna/fna.asp>. 2013. Farmacopea Argentina. 7ed; 2014.
- Kutschker A, Menoyo H, Hechem V (2002) Plantas medicinales de uso popular en comunidades del oeste del Chubut. Ed. Bavaria. INTA-UN de la Patagonia S.J.B.-GTZ, Bariloche
- Kutschker A, Ezcurra C, Balzaretto V (2010) Valeriana (Valerianaceae) de los Andes australes: biodiversidad y compuestos químicos. In: Pochettino ML, Ladio AH, Arenas PM (eds) Tradiciones y Transformaciones en Etnobotánica. CYTED, La Plata, pp 219–224
- Ladio AH (2006) Gathering of wild plant foods with medicinal use in a Mapuche community of Northwest Patagonia. In: Pieroni A, Price LL (eds) Eating and healing: traditional food. Harworth Press, Philadelphia, pp 297–321
- Ladio AH, Lozada M (2009) Human ecology, ethnobotany and traditional practices in rural populations inhabiting the Monte region: resilience and ecological knowledge. *J Arid Environ* 73(2):222–227. <https://doi.org/10.1016/j.jaridenv.2008.02.006>
- Ladio AH, Lozada M, Weigandt M (2007) Comparison of traditional wild plant knowledge between aboriginal communities inhabiting arid and forest environments in Patagonia, Argentina. *J Arid Environ* 69(4):695–715. <https://doi.org/10.1016/j.jaridenv.2006.11.008>
- Martínez Crovetto R (1980) Apuntes sobre la vegetación de los alrededores del Lago Cholila. Publicación Técnica Fac Cien Agrarias 1:1–22

- Molares S (2010) Flora medicinal aromática de la Patagonia: características anatómicas y propiedades organolépticas utilizadas en el reconocimiento por parte de la terapéutica popular. Tesis Doctoral. Universidad Nacional del Comahue. Bariloche
- Molares S, Ladio AH (2009a) Chemosensory perception and medicinal plants for digestive ailments in a Mapuche community in NW Patagonia, Argentina. *J Ethnopharmacol* 123(3):397–406. <https://doi.org/10.1016/j.jep.2009.03.033>
- Molares S, Ladio AH (2009b) Ethnobotanical review of the Mapuche medicinal flora: use patterns on a regional scale. *J Ethnopharmacol* 122(2):251–260. <https://doi.org/10.1016/j.jep.2009.01.003>
- Molares S, Ladio AH (2012) Plantas aromáticas con órganos subterráneos de importancia cultural en la patagonia argentina: una aproximación a sus usos desde la etnobotánica, la percepción sensorial y la anatomía. *Darwiniana* 50(1):7–24
- Ochoa JJ, Ladio AH (2011) Pasado y presente del uso de plantas silvestres con órganos de almacenamiento subterráneos comestibles en la Patagonia. *Bonplandia* 20(2):265–284
- Ochoa JJ, Ladio AH (2014) Ethnoecology of *Oxalis adenophylla* Gillies ex Hook. & Arn. *J Ethnopharmacol* 155:533–542
- Richeri M, Cardoso MB, Ladio AH (2013) Soluciones locales y flexibilidad en el conocimiento ecológico tradicional frente a procesos de cambio ambiental: estudios de caso en Patagonia. *Ecol Austral* 23:184–193
- Toledo C, Kutschker A (2012) Plantas Medicinales en el Parque Nacional Los Alerces, Chubut, Patagonia Argentina. *Bol Soc Argent Bot* 47(3–4):461–470
- Weigandt M, Ladio AH, Lozada M (2004) Plantas medicinales utilizadas en la comunidad Mapuche Curruhuinca. Ediciones Imaginaria, Bariloche. 75 pp
- Zuloaga FO, Morrone O, Belgrano JM (2008) Catálogo de las plantas vasculares del Cono Sur. *Monographs in systematic botany from the Missouri Botanical Garden*. Ed. Missouri Botanical Garden Press. <http://www2.darwin.edu.ar>