

Adesmia boronioides Hook. f.



Silvia Beatriz González



Adesmia boronioides Hook. f. (Photo by the author)

Abstract *Adesmia boronioides* Hook. f. (Leguminosae), known as “paramela”, is an aromatic and medicinal plant widely used in the Patagonia region (South of Argentina). It has been used traditionally as medicinal and also for its aromatic and

S. B. González (✉)

LIPAM (Laboratorio de Investigación de Plantas Aromáticas y Medicinales), Facultad de Ciencias Naturales y Ciencias de la Salud, Universidad Nacional de la Patagonia San Juan Bosco sede Esquel, Esquel (9200), Chubut, Argentina

e-mail: quim-esq@unpata.edu.ar; silviaesquel@speedy.com.ar

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ornamental qualities. This species has received an increasing interest by its fragrant odor and the potential use of its essential oil in perfumery. However, the oil composition of “paramela” wild populations from Patagonia showed a wide chemical variability, so experimental crops from selected plants was introduced in the Andean region in order to select the best plant material for essential oil production.

Keywords “Paramela” · Leguminosae · Patagonia · Aromatic · Esquelenone

1 Introduction

Adesmia boronioides Hook. f. (“paramela”) is a very well-known aromatic and medicinal species growing wild in the Patagonia region of Argentina and Chile. It is used in rural areas mainly as a medicinal infusion, and in urban areas both as ornament and aromatic ingredient for the preparation of an alcoholic beverage. This native plant of the Patagonian region is almost exclusively found in its wild state. However, in the rural communities *A. boronioides* is cultivated in family orchards. Recently its essential oil has been introduced as a valuable raw material for perfumery, placing the species in an incipient domestication process.

2 Taxonomic Characteristics

Adesmia boronioides Hook. f., Leguminosae (Fabaceae), is popularly known as “paramela”, “yagneu”, “lonckotrevo”, “té pampa”, “té silvestre”, “yerba Carmelita” and “éter” (González 2002; Barboza et al. 2009). The *Adesmia* DC genus includes almost 240 species and can be found only in South America (Burkart 1967). The different species reported are mainly distributed in the center of Chile and in the South and West regions of Argentina (Burkart 1967; Ulibarri and Burkart 2000).

In particular, the genus is represented by more than 100 species for Argentina, making it the most numerous genus of the Leguminosae (subfamily Papilionoideae) in the country, while 55 species are present in the Patagonian region (Burkart 1984; Ulibarri and Burkart 2000; Ulibarri and Simpson 2010).

3 Crude Drug Used

The aerial parts of *A. boronioides* have been used in traditional medicine to treat rheumatic pains, colds, and digestive disorders; as well as a decongestant for the respiratory tract (Montes and Peltz 1963; Montes and Wilkomirsky 1987; Simirgiotis et al. 2012). The aerial parts have been also used popularly in preparing incenses to

cleanse the houses. Occasionally, the dried leaves and stems are sold in herb-shops and as ornamental (Green and Ferreyra 2011).

4 Major Chemical Constituents and Bioactive Compounds

The leaves and stems of *A. boronioides* from Patagonia, Argentina yielded variable amounts of essential oil according to the season latitude and its ecological conditions (González et al. 2004). The main components of its essential oil are two bisnorsesquiterpenes (esquel-6-en-9-one and esquel-7-en-9-one, named from Esquel, city of the Argentinean Patagonia, where “paramela” grows) as well as α -copaen-11-ol, δ -cadinene, 10-epi- γ -eudesmol, 4 α -hydroxydihydroagarofuran, 1-epi-cubenol and α -pinene. The structural elucidation of the main components was performed through NMR (mono and bidimensional), vibrational circular dichroism (VCD) and its absolute configuration was finally reassigned (González et al. 2002; Cerda-García-Rojas et al. 2015).

The very pleasant sweet-woody, licorice-spicy odor and strong fixation properties of the oil was suggested to be used in the fragrance industry (Bandoni 2000; González et al. 2002).

Moreover, it was also demonstrated that the essential oil composition varies according to latitude and its ecological conditions, as soil, weather, altitude and living organisms associated (González et al. 2016; González and Martin 2019).

5 Morphological Description

A. boronioides (“paramela”) is a perennial bush. It has a medium size (0.4–2.0 m), highly ramified with glandular branches, fragrant and very resinous and sticky to the touch. The leaves 3–6 cm, shortly petiolate, 10–20 leaflets, leaf rachis with erect, brief hair; obovate, fleshy, glabrous, toothed, shiny, 4–6 mm leaflets with crateriform glands especially at the edge; short, amplexicaul, glabrous, glandular stipules. The flowers are 7–10 mm, colorful, yellow, perfumed, with campanulate calice, pubescent, glandulous, with short teeth, serice-pubescent in their interior; glabrous vexillum (banner), glabrous wings and keel shorter than vexil. Ovary with some marginal hair. Narrow, pubescent, glandular, 35-articulate loments; semicircular, dehiscent 4.5–6 mm trusses. Roots are axonomorph (González et al. 2019).

A. boronioides stands out as the only species of this genus highly glandulous-resinous (Burkart 1967). Its anatomy was initially studied by Nájera et al. (2000). Subsequently, in an evaluation of leaves and stems of diverse origins in their Patagonian distribution, very similar microscopic characters were found. They all have cyclocytic stomata on the leaf’s epidermis. The secretory pores are located, in greater number, on the abaxial surface, although some pores can be observed on the

adaxial surface. On some samples, secretion pores were found at the end of the leaves (González et al. 2014).

6 Geographical Distribution

The *A. boronioides* distribution ranges from Mendoza to Tierra del Fuego provinces, in Argentina, including Neuquén, Río Negro, Chubut, and Santa Cruz, and the XI and XII Regions of Chile (<http://www2.darwin.edu.ar/Proyectos/FloraArgentina/fa.htm>; Burkart 1967; Ulibarri and Burkart 2000). The species grows wild up to 2200 m.a.s.l.

It inhabits sunny areas, shrubs, river sides, roads and ravines, mainly in the Patagonian steppe, shrubland areas and steppe-forest transition zones (https://www.sib.gov.ar/ficha/PLANTAE*adesmia*boronioides). It has also been found in the Atlantic littoral, Santa Cruz Province, at Rio Gallegos area (González et al. 2014). It grows in shrubland vegetation near Los Molles, province of Mendoza (Argentina).

7 Ecological Requirements

A. boronioides is native of the Patagonian region inhabiting low irrigation sites being of slow growth. It is found almost exclusively in its natural state, being its culture of interest (Barthélémy et al. 2008; Contardi et al. 2016a, b).

Reproduction studies made from *A. boronioides* seeds allowed the development of propagation protocols and plants production in greenhouses (González et al. 2009; Sánchez and Riat 2012; Mazzoni et al. 2014, 2016). As of overharvesting and excessive commercial exploitation of wild populations, its domestication has gained on importance. Since 2015, an experimental culture in the Andean region of the Argentinean Patagonia was developed in order to evaluate the productivity and quality of the cultivated plant's essential oil by comparison with the wild populations (González et al. 2018).

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

Aerial parts, with or without flowers (Photo 1), are used as medicine by the Patagonian rural population, mostly as digestive, antirheumatic, diaphoretic and antiemetic (Campos et al. 1997; González et al. 2004, 2005a, b; Estomba et al. 2006). Traditionally, the plant material is collected in autumn-winter, dried and kept in dark places to use it as home medicine by rural communities during the whole year (Richeri et al. 2013a, b). The people distinguish it by its “perfumed” character,



Photo 1 Flowers and leaves of *A. boronioides*. (Photos by the author)

and it is described as a plant possessing “magical soul”, “sweet smell and bitter taste” (Molares and Ladio 2009; Ladio and Molares 2014).

A. boronioides is also valued by “heating the body” when prepared in the form of steam inhalations and baths (González 2005). Steam inhalation is a common practice for cold and cough discomfort in Neuquén, Río Negro and Chubut Provinces communities (Igon et al. 2006; Eyssartier et al. 2011a, b; Richeri et al. 2013a, b). Richeri (2016) also records the use of the plant as incense to perfume and cleanse the houses of evil spirits. According to Ochoa (2015), the species is also used in ointment as a sedative for rheumatic problems and to heal wounds.

The infusion of “paramela” is widely used as digestive (Igon et al. 2006), being also included in the “mate”, a traditional drink of the region, mainly composed of *Ilex paraguariensis* dried leaves (Weigandt et al. 2004). It is usually found marketed in tourist shops and crafts businesses where is sold in San Carlos de Bariloche (South Argentina) as medicinal plant mainly for its digestive properties (Cuassolo et al. 2010) and to wash the hair in order to kill lice and as hair vitalizer (Martínez-Crovetto 1980; Conticello et al. 1997; Igon et al. 2006). Some studies have also reported its use as aphrodisiac (Muñoz et al. 2001; Igon et al. 2006; Barboza et al. 2009). In other Argentine regions of Province of Río Negro, people emphasize the use of the plant’s decoction to ease flu, stomach pains, diarrhea, and fever (Eyssartier et al. 2009, 2011a, b, 2013).

9 Modern Medicine Based on Its Traditional Medicine Uses

The properties of infusions from aerial parts of *A. boronioides* were investigated showing anticancer potential due to their antiproliferative activity on human cancer cell lines (Gastaldi et al. 2018). Antioxidant activity, most likely due to the presence of phenolic compounds and flavonoids has also been reported (Gastaldi et al. 2016a; Silva Sofrás et al. 2016). Resinous exudate obtained from the aerial parts of *A. boronioides* were evaluated by its anti-phytopathogenic effects (Montenegro et al. 2019). The plant is also a scent agent in the fragrance industry (González et al. 2002). Moreover, the essential oil showed *in vitro* trypanocidal effect even with IC₅₀ value lower than that of benzimidazole, used as reference drug (Villagra et al. 2008).

The dermal irritability test performed on albino rabbit skin using *A. boronioides* essential oil evaluating erythema and edema formation, showed the oil safety use under the test conditions according to the methodology of Draize (González 2002).

The use of *A. boronioides* to joint and muscle pains in traditional medicine could be linked to their anti-inflammatory activity tested *in vitro* (González et al. 2003).

In addition, the toxicity values found for an infusion of *A. boronioides* tested using *A. salina* suggests no risk of acute toxicity to humans (Mongelli et al. 1995; Pérez and Lazo 2010; Gastaldi et al. 2016b, 2018).

Actually, *A. boronioides* is commercialized in three forms: (a) as an ingredient in alcoholic beverages, (b) as a medicinal herb, mainly in infusions and decoctions, being the one of the most common native medicinal plant commercialized in the region (Cuassolo et al. 2010), and (c) its essential oil is used more and more as a raw material for perfumery.

More recently the species has been incorporated into the Argentine Food Code (Código Alimentario Argentino 2019) as a food additive for use as a flavoring, and an oil/water emulsion was developed for the encapsulation of the essential oil (Martinez et al. 2019).

10 Conclusions

A. boronioides has a long history of use in Patagonian communities as an aromatic and medicinal plant, making it one of the most commercialized native species in the urban centers of the region. Over the past years, there has been a notable increase in the demand for this plant because of its outstanding aromatic quality, increasing the pressure of harvesting on wild populations. As consequence, a few experiences of propagation have been developed whose results suggest that it would be feasible to produce large-scale seedlings to establish future crops as a productive alternative for the region.

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