



FLORISTIC AND TAXONOMIC NOTES ON *NAJAS* (HYDROCHARITACEAE) IN ARGENTINA

Notas florísticas y taxonómicas sobre *Najas* (Hydrocharitaceae) en Argentina

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Summary: *Najas* is a cosmopolitan genus belonging to the family Hydrocharitaceae; *Najas marina* is a submerged aquatic herbaceous species, with prickly stems and leaves, living in fresh or brackish waters of shallow lakes. The aim of this work was to report the presence of *N. marina* in an urban lake in the city of San Miguel de Tucumán (Tucumán, Argentina), being the first record of the genus in northwestern Argentina. Previous reports of *N. marina* in Argentina included the provinces of Corrientes, Mendoza, Misiones, San Luis and Santa Fe. Specimens collected in the northeast of the country (provinces of Corrientes and Santa Fe) previously cited as *N. marina* correspond to *Najas major*, characterized by having unarmed stems and leaves.

Key words: Alismatales, hydrophytes, *Najas major*, *Najas marina*.

Resumen: *Najas* es un género cosmopolita perteneciente a la familia Hydrocharitaceae; *Najas marina* es una especie herbácea acuática sumergida, con tallos y hojas armados con aguijones, que vive en aguas dulces o salobres de lagos poco profundos. El objetivo de este trabajo fue reportar la presencia de *N. marina* en un lago urbano de la ciudad de San Miguel de Tucumán (Tucumán, Argentina), siendo el primer registro del género en el noroeste argentino. Reportes previos de *N. marina* en Argentina incluyeron las provincias de Corrientes, Mendoza, Misiones, San Luis y Santa Fe. Los especímenes colectados en el noreste del país (provincias de Corrientes y Santa Fe) previamente citados como *N. marina* corresponden a *Najas major*, caracterizada por tener tallos y hojas sin aguijones.

Palabras clave: Alismatales, hidrófitas, *Najas major*, *Najas marina*.

Introduction

Hydrocharitaceae (Alismatales) is a monocotyledonous plant lineage including annual or perennial, floating or submerged plants of both, fresh and marine water environments, in a wide variety of habitats (e.g. shallow lakes, lagoons, salt marshes). The family consists of around 16 genera and approximately 135 species, widely distributed in tropical and subtropical regions (Les et al., 2006). One of

the genera, *Najas* L., includes annual, rarely perennial submersed herbs with leaves nearly opposite or appearing whorled, sessile, and unisexual flowers solitary or grouped in axillar inflorescences often subtended by spathe as involucre, sessile or short-pedunculate. The genus is almost cosmopolitan, with four native species in the Southern Cone of South America (<http://www.floraargentina.edu.ar/>) although there are not comprehensive taxonomic studies for Argentina.

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The genus *Najas* belongs to the subfamily Hydrilloideae Luer (Les *et al.*, 2006), and includes ca. 40 species gathered in two subgenera, *Caulinia* (Willd.) Aschers., spineless, monoecious plants and *Najas*, with one dioecious, polymorphic species, *Najas marina* L., armed with spines (Lowden, 1986; Triest, 1988). This is a subcosmopolitan, aquatic, completely submersed in shallow lakes (1-3 m deep) species, currently viewed as comprising 12 different subspecies and four varieties (Triest, 1988) but with no infraspecific taxa recognized in the Neotropical revision (Lowden, 1986) although Triest (1988) treated the American specimens as *N. marina* subsp. *intermedia* (Wolff. ex Gorski) Casper.

In the Southern Cone of South America, *N. marina* is registered only for Brazil and Argentina. In the last country the species was previously mentioned in the provinces of Corrientes, Mendoza, Misiones, San Luis, and Santa Fe in both, natural and artificial aquatic environments (Brumnick & Schneider, 2020), but the identity of Argentinian taxa needs modern revision. The aim of this work is to expand the distribution of the genus *Najas*, with the species *N. marina*, for Northwestern Argentina and correct the identity of the taxon cited for the Northeastern part of the country.

Material and Methods

Plant collection

The specimens were collected in November 2024 in San Miguel lake an artificial wetland located at 26°49'58.29"S, 65°11'20.80"W, in 9 de Julio park, San Miguel de Tucumán city, Argentina (Fig. 1). Geographic coordinates of the sampling site were obtained using an Etrex Garmin GPS. The specimens are stored at LIL (acronym following Thiers, continuously updated). Additionally, *Najas* specimens from Argentina stored in CORD, CTES, LIL, LP, MERL, RCVC, SI and STL herbaria were studied. The specimens were identified with the specific bibliography: Hunziker, 1966; Haynes, 1979; Lowden, 1986; Triest, 1987, 1988; Urquiola Cruz *et al.*, 1998; Talavera & Gallego, 2010; Wang *et al.*, 2010.

Study area

The lake has a surface of approximate 3 hectares, and a maximum depth of 1.5 m. A pumping system supplies the lake with groundwater draining towards an urban channel which contributes water to the Salí River (La Gaceta, 2018).

Regional climate is subtropical with a dry season during the period October to March (spring and summer). Annual rainfall varies between 900 to 1,000 mm and average environmental temperature from 18 to 20 °C (Guido & Sesma, 2014). Natural landscape was transformed completely by urban development, but some native tree species are represented among the park trees. The park is a public open space designed for recreational use, managed by the local government. San Miguel lake is surrounded by an urban environment contributing to the removal of pollutants from runoff through sedimentation, biological uptake, and plant filtration.

Although there is no data on ion nor nutrient concentrations of the lake some physicochemical parameters were measured by Taboada & Bustos (2020, Table 1).

Sampling and processing techniques followed Mori *et al.* (1989).

Results and Discussion

Najas marina L., Sp. Pl.: 1015. 1753. *Typus*: [Finland] Aland (*lectotypus* LINN 1156.1 image!), designated by Viinikka in Ann. Bot. Fenn. 13: 128. 1971). Fig. 2.

Annual herbs, aquatic, glabrous, submersed in fresh or brackish waters. Stems slender, branched distally, 6-45 cm long, 0.5-4 mm wide; internodes 0.3-11 cm, rooting at proximal nodes, armed with prickles on internodes. Leaves linear to linear-lanceolate, spreading to ascending, 1.5-3.9 cm long; sheaths with apex acute; blade 0.5-4.5 mm wide, 1-veined, armed with prickles on midvein abaxially, margins coarsely serrate to dentate, teeth 8-13 per side, similar in size and structure to those of blades, apex acute, with 1 tooth, teeth multicellular terminated by large, sharp-tipped cell. Flowers dioecious, 1 per



Fig. 1. *Najas marina* in San Miguel Lake. A: Map with geographic references. B: Photograph of the sampling site. C: Photograph of submersed plants.

axil. Staminate flowers in distal to proximal axils, involucre beak 2-lobed; peduncle short, elongating at anthesis, pushing flower through involucre; anther sessile, 4-loculed. Pistillate flowers in distal to proximal axils, sessile, 2.5–4 mm long; ovary 1-loculed; ovules basal, 1; style 1–1.5 mm long; stigmas 3-lobed. Fruits achene-like. Seed 1. Seeds reddish brown, ovoid, 2–4 mm long, apex with style situated at centre; testa dull, with areoles irregularly arranged, angled, longer than broad, end walls slightly raised giving to the testa a papillose appearance.

Material studied: **ARGENTINA.** **Tucumán:** Dep. Capital, 26°49'58.29"S, 65°11'20.80"W, 424 m. a.s.l., 15-XI-2024, Delgado *et al.* 1301 (LIL).

Phenology: *Najas marina* flowers from September to November, and seeds ripen in the same period.

Vernacular name: “Holly-leaved Naiad”, or “spiny water nymph” (Triest, 1988), “náyade mayor” in Spain.

Observations: *Najas marina* is well characterised owing its prickly internodes and prickles along the abaxial surface of the leaves. The plants are growing in semi-shade or preferably no shade completely submerged but near the surface and rooting extensively in sediments.

Over its entire range, the species displays considerable morphologic variability (Triest *et al.*, 1986), giving cause for 12 subspecies to be recognized (Triest, 1988). In contrast to the currently proposed taxonomy, an analysis of DNA sequence data for 22 globally distributed populations resolves in two distinct lineages named as *N. marina* subsp. *marina* and *N. marina* subsp. *intermedia*, sometimes treated as separate species (Rüegg *et al.*, 2017).

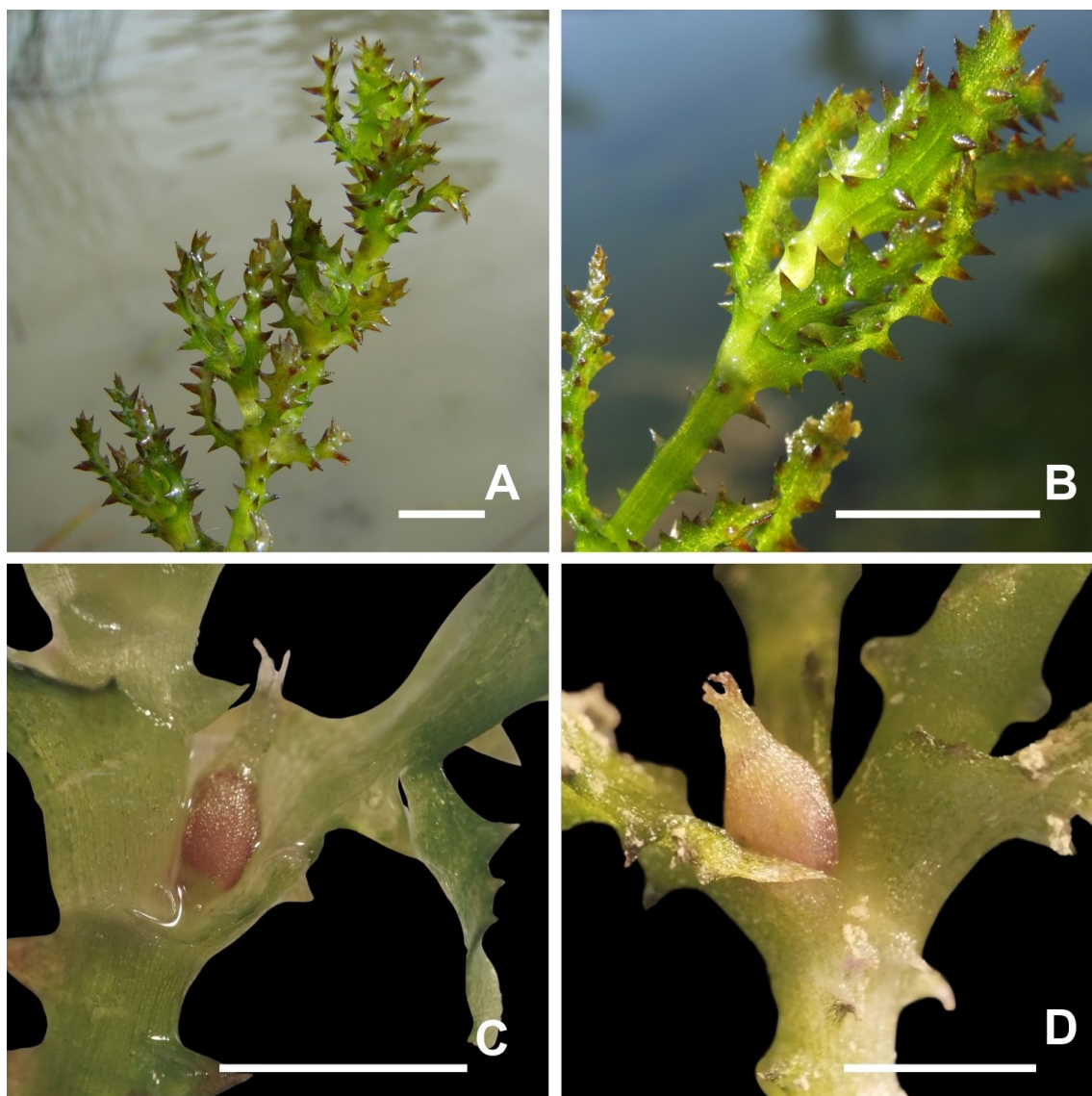


Fig. 2. *Najas marina*. A: Habit. B: Detail of stem and leaves with prickles. C: Pistillate flower. D: Fruit. Scales: A: 2.5 cm; B: 3 cm; C-D: 3 mm.

Given the considerable differences in karyotype (Viinikka, 1976, 1977), the clear-cut allelic divergence in isozyme loci (Triest *et al.*, 1986; Triest, 1989, 1991), the existence of F1 hybrids with low or no seed set (Triest, 1991) and the correlation of these findings with molecular data (Rüegg *et al.*, 2017) support the treatment of the two lineages as separate species (Bräuchler, 2015), criteria followed here. This point

of view regards all names listed in the synonymy of *N. marina* subsp. *intermedia* by Triest (1988) are to be treated as *N. marina*, which includes all plants with spiny stems, regarding the spineless plants as *Najas major* All. (Bräuchler, 2015).

The recent record of *N. marina* in lake San Miguel is likely the result of the recent migration of Anatidae species from central Argentina, including *Dendrocygna viduata*

Table 1. Some physicochemical parameters registered in San Miguel lake (from Taboada & Bustos, 2020).

Parameters	Winter (august/19)	Spring (november/19)	Summer (February/20)
pH	7,9	8,2	8
Conductivity (µS/cm)	128	95	67
Temperature (° C)	15	18	22

(Linnaeus, 1766) (Echavarria, pers. comm.). This species may have played an important role in the dispersal of seeds of *N. marina* that were previously documented in the lagoons of central Argentina (Hunziker, 1966). It is noteworthy that the species is an excellent waterfowl food (Whyte & Silvy, 1981; Tarver *et al.*, 1986).

Some south American Anatidae are known to migrate over long distances per day, including a route from central to northern Argentina (Pérez *et al.*, 2011 and references herein). As seeds of *Najas* are retained in the birds' gut for over 10 h, it seems reasonable to assume that the seeds can be transported in one hop from one site to another (Agami & Waisel, 1986), which could contribute to the presence of *Najas* in the artificial San Miguel lake. Also, plants belonging to genus *Najas* are reported to reproduce by seed and also fragmentation (Tarver *et al.*, 1986). Intact seeds of *N. marina*, when set to germinate in mud, attain very low percentages, whereas after the seed coats were mechanically cracked, germination increased considerably (Agami & Waisel, 1986). Therefore, it could be possible that a certain mechanism which causes the seed coats of *Najas* to rupture, as when goes into the digestive system of many species of Anatidae (Whyte & Silvy, 1981), would explain the distribution and establishment of this species.

Regarding the specimens collected in Northeastern Argentina (Corrientes and Santa Fe provinces) and Cuyo (Mendoza), identified previously as *N. marina* (Brumnick & Schneider, 2020) are in fact *N. major* All., which is characterised by the spineless stems and midvein of leaves.

Key for species of *Najas* from Argentina

1. Plants armed with prickles on stems and midvein abaxially. *N. marina*
- 1'. Plants unarmed, stems smooth. 2
2. Plants dioecious. *N. major*
- 2'. Plants monoecious.
..... *N. guadalupensis* (Spreng.) Magnus

Material examined: Najas guadalupensis.

Córdoba: Dep. Santa María, Lagunas del Bajo del Manzano y Los Molinos, 13-II-1877, *Hieronymus* 745 (GOET, US); Embalse José de la Quintana, 26-VI-1966, *Hunziker* 18470 (CORD). Dep. San Alberto, Chuba, entre Chancaní y El Chocolate, camino a Villa Dolores, 1-I-1973, *Hunziker* 22181 (CORD); Sierra de Pocho (falda oeste), Bañado de Paja, entre San Pedro y El Chocolate, 16-VI-1960, *Hunziker & Cocucci* 14693 (CORD). Dep. Tulumba, Salinas Grandes, entre San José y Lucio V. Mansilla, 25-III-1964, *Hunziker & Cocucci* 17153 (CORD). **Corrientes:** Dep. Mburucuyá, Estancia santa Teresa, río Santa Lucía, 16-IV-1976, *Krapovickas & Cristóbal* 29587 (CTES, LIL); Santa Teresa, 17-XI-1957, *Pedersen* 4666 (GH, NY, US). **Salta:** Dep. Orán, Laguna El Palmar prope San José, 28-VI-1873, *Lorentz & Hieronymus* 553 (NY). *Najas major*. **Corrientes:** Dep. Monte Caseros, Arroyo Timboi, Ea. La Potota, 25-II-1968, *Nicora* 7393 (BAA). **Mendoza:** Dep. Las Heras, Parque General San Martín, sumergida en las aguas del lago, abundante, 12-I-1944, *Ruiz Leal* 8344 (CORD, MERL). **Santa Fe:** Dep. La Capital, laguna "Los Gansos", aislada de cauces activos, a unos 300 m del brazo

Paraná Viejo, 31°46'56.7''S, 60°41'25.98''W, ca. 5 m a.s.l., 29-XI-2013 (fr), *Schneider 40* (STL). *Najas marina*. **Córdoba:** Dep. Juárez Celman, Reserva Natural de Fauna Laguna La Felipa, puente, 7-III-2023, *Arana & Oggero 7298* (RCVC). **San Luis:** Dep. General Pedernera, Laguna de las Casas en la Estancia Juan del Tastú, entre Soven y La Portada, 29-I-1963, *Hunziker & Maldonado 16198* (CORD). Dep. Juan Martín de Pueyrredón, 29-I-1994, *Bianco et al. 5028* (RCVC, RIOC).

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