Acta Zoológica Lilloana 69 (2): 583-598, 7 de diciembre de 2025

Occurrence and morphological variability of *Hydra* (Hydroida: Hydridae) in freshwater bodies of Southeast of Buenos Aires Province, Argentina

Presencia y variabilidad morfológica de *Hydra* (Hydroida: Hydridae) en cuerpos de agua dulce del Sudeste de la Provincia de Buenos Aires, Argentina

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Abstract

Hydra constitutes a monophyletic clade of sessile and solitary polyps that occur on all continents except Antarctica. Despite its widespread presence in freshwater habitats, *Hydra* requires reasonably unpolluted conditions for survival, making its presence a reliable indicator of good water quality and a certain degree of ecosystem conservation. Since their discovery, these polyps have become valuable biological models due to their morphological simplicity, global distribution, and low maintenance requirements in the laboratory conditions, enabling experiments on regeneration, reproduction, senescence, cellular differentiation, among other processes. All *Hydra* species are clustered into four morphological groups: *viridissima* (green), *vulgaris* (common), *oligactis* (stalked), and *braueri* (gracile). Species in the *viridissima* group are green due to the presence of intracellular symbiotic algae, whereas the brown hydras (*braueri*, *oligactis*, and *vulgaris*) lack such endosymbionts. The *oligactis* and *braueri* groups are restricted to the Northern

➤ Ref. bibliográfica: Kesavan, R.; Abinesh, A.; Saran, M.; Vignesh, E.; Shree, A.; Shahir, M.; Moinudheen, N.; Samson, A.; Ali, S. 2025. "Silent Invaders: Biodiversity at Risk, Social Media findings into Exotic Pet Trade in Tamil Nadu and Invasion Modeling of *Iguana iguana* (Linnaeus, 1758)". *Acta Zoológica Lilloana 69* (2): 583-598. DOI: https://doi.org/10.30550/j.azl/2227
➤ Recibido: 19 de mayo 2025 – Aceptado: 30 de junio 2025.
➤ URL de la revista: http://actazoologica.lillo.org.ar

Hemisphere, while the *viridissima* and *vulgaris* groups include cosmopolitan species. To date, only five published records documenting the presence of *Hydra* in Argentina are available in the scientific literature. In the present study, we report six new occurrences from four wetlands in the southeastern region of Buenos Aires Province: two each for *H. viridissima, H. vulgaris,* and *H. vulgaris pedunculata*. The study includes a quantitative morphological analysis (body measurements, cnidome, and reproductive structures) to assess intraspecific variation among populations from different freshwater bodies. These findings expand the known distribution of *Hydra* in South America and provide reference data for future ecological and taxonomic studies.

Keywords: Freshwater cnidarians, intraspecific variation, wetlands.

Resumen

Hydra constituye un clado monofilético de pólipos sésiles y solitarios que se encuentran en todos los continentes, excepto en la Antártida. A pesar de su amplia distribución en hábitats de agua dulce, *Hydra* requiere ambientes poco contaminados para sobrevivir, lo que convierte su presencia en un indicador confiable de buena calidad del agua y de cierto grado de conservación del ecosistema. Desde su descubrimiento, estos pólipos se han convertido en un valioso modelo biológico debido a su simplicidad morfológica, distribución global y bajos costos de mantenimiento, lo que ha permitido la realización de experimentos sobre regeneración, reproducción, senescencia, diferenciación celular, y otros procesos biológicos relacionados. Todas las especies de *Hydra* se agrupan en cuatro grupos morfológicos: *viridissima* (verde), *vulgaris* (común), *oligactis* (pedunculada) y *braueri* (grácil). Las especies del grupo *viridissima* son de color verde debido a la presencia de algas simbióticas intracelulares, mientras que las hidras marrones (*braueri*, *oligactis* y *vulgaris*) carecen de estos endosimbiontes. Los grupos *oligactis* y *braueri* están restringidos al hemisferio norte, mientras que los grupos *viridissima* y *vulgaris* incluyen especies cosmopolitas. Hasta la fecha, solo se dispone de cinco registros publicados que documentan la presencia de *Hydra* en Argentina. En el presente estudio, se reportan seis nuevos registros procedentes de cuatro humedales de la región sudeste de la provincia de Buenos Aires: dos correspondientes a *H. viridissima,* dos a *H. vulgaris y* dos a *H. vulgaris pedunculata*. El estudio incluye con un análisis morfológico cuantitativo (medidas corporales, cnidoma y estructuras reproductivas) para evaluar variaciones intraespecíficas entre poblaciones de distintos cuerpos de agua dulce. Estos hallazgos amplían la distribución conocida de *Hydra* en América del Sur y proporcionan datos de referencia para futuros estudios ecológicos y taxonómicos.

Palabras clave: Cnidarios dulceacuícolas, variación intraespecífica, humedales.

INTRODUCTION

The genus *Hydra* constitutes a monophyletic clade (Collins et al., 2006) of sessile and solitary polyps, often attached to submerged and floating macrophytes, that occurs in all continents, except Antarctica (Jankowski, Collins and Campbell, 2008). This genus is usually more abundant in lentic waters (Elliot et al., 1997). Despite its widespread occurrence in freshwater habitats, *Hydra* is highly sensitive to water quality, necessitating reasonably unpolluted conditions for its survival (Bossert and Galliot, 2012). Like others hydrozoans (Edwards, 2012; Folino-Rorem et al., 2016), this sensitivity renders its presence in freshwater ecosystems a reliable indicator of good water quality, and a certain state of conservation of the ecosystems.

Hydra is the typical model for illustrating cnidarians in their sessile stage, but since its discovery, it has also become an attractive biological model for the study of diverse mechanisms, such as regeneration, reproduction, cellular differentiation, early nervous, immune responses (Galliot, 2012), and as a test organism for bioassays (Pica Granados, Ronco and Baez, 2004). Their morphological simplicity, ubiquity, wide global distribution, substrate diversity, and easy and low maintenance costs in the laboratory made these organisms the ideal subject for numerous experiments (Bossert & Galliot, 2012).

All *Hydra* species are clustered into four morphological groups: *viridissima* (green hydras), *vulgaris* (common hydras), *oligactis* (stalked hydras), and *braueri* (gracile hydras), corroborated by DNA analyses (Martínez et al., 2010). Hydras of the *viridissima* group are green due to intracellular symbiotic algae, and hydras from the *braueri*, *oligactis*, and *vulgaris* groups not carry algal endosymbionts and they are referred to as brown hydra (Campbell, 1983). The *oligactis* and *braueri* groups are restricted to the Northern Hemisphere, while the *viridissima* and *vulgaris* groups have the two most cosmopolitan species: *Hydra viridissima* and *Hydra vulgaris*, respectively (Martínez et al., 2010).

The taxonomy of the genus is based primarily on Eurasian and North American species, with authors such as Schulze (1917), Hyman (1929), Ewer (1948) and later Forrest (1963), Kanaev (1969) and Campbell (1989) as pioneers in the classification of species. With the discovery and reclassification of these organisms within the animal kingdom, numerous species were described indiscriminately, leading to an exponential increase in the number of species assigned to the genus (Campbell, 1989). The plasticity of morphological characters, and what we now recognize as intraspecific variability, generated considerable taxonomic confusion. Many of these species have been synonymized and the taxonomic status of others is still controversial (Campbell, 1987). For example, of the more than 80 species described in recent centuries, it is suggested that less than 15 are actually valid (Jankowski et al., 2008), while in World Register of Marine Species (WORMs, 2025), a total of 40 species are listed.

Despite being a pioneer in the study of freshwater hydrozoans with the studies of Gaggero (1923), Ringuelet (1950), Ringuelet and Olivier (1954) and Dioni (1968), Argentina has few references to this genus for its freshwater environments. Many of the findings are personal observations that do not have a bibliographic citation in the official literature, making it difficult to obtain this information. To date, some polyps discoveries of this genus have been reported, but many of them are only found in wildlife observation databases, so there is no precise information about these species regarding their cnidoma, morphology, or ecological habits.

To date, only five reports of *Hydra* species have been recorded in Argentina: *H. plagiodesmica* from the Santiago River in Santa Fe Province (Dioni, 1968); *H. viridissima* from Corrientes (Kassor, Avalos and Monti-Areco, 2025); and *H. vulgaris*, *H. pseudoligactis*, and the subspecies *H. vulgaris pedunculata* from Buenos Aires Province (Deserti & Zamponi, 2011; Deserti et al., 2011, 2012). It is also worth highlighting the occurrence of brown *Hydra* sp. in Bahia Blanca, a record deposited on the iNaturalist platform.

The objective of this work was to present recent findings on the genus *Hydra* from the southeast of Buenos Aires Province: two for *H. viridissima*, two for *H. vulgaris* and two for *H. vulgaris pedunculata*, including their morphological descriptions, in order to contribute to the taxonomic and ecological knowledge of this group in regions of the Southern Hemisphere.

MATERIALS AND METHODS

Study area

The specimens were collected at the following sites: Los Padres lagoon Natural Reserve (37º56' S; 57º45' W), Nahuel Rucá lagoon (37º 40' S, 57º 23' W), La Brava lagoon (37°53' S; 57°58' W), and La Tapera stream and artificial lake in Camet Park (37°56' S, 57°32' W).

Sampling and reconditioning methodology

The same sampling methodology was applied at all sites: samples of carpet vegetation, as well as two samples each of floating and submerged vegetation, were collected separately and placed in 1-liter plastic containers filled with ambient water. The samples were then transported to the laboratory, where they were conditioned with aerators and exposed to a natural photoperiod. The polyps were placed in Petri dishes with Culture Solution M (Lenhoff, 1983), fed twice a week with brine shrimp *nauplii* larvae and the culture water was completely changed once a week.

Measurement of characters

For each polyp, the following morphological characteristics were measured:

– **General**: color; column length; presence or absence of a peduncle. For tentacles, the total number, relative length, most frequent number (mode), and the tentacle growth pattern in young buds. Relative tentacle length was estimated by visually comparing the full extension of tentacles in each polyp. These observations were made on all polyps collected at each site (Tables 1-3).

– **Cnidom**: The shape was described, and the width and length of 30 undischarged capsules per polyp from each of the four cnidocyst types present in the genus (stenoteles, desmonemes, atrichous isorhizas, and holotrichous isorhizas), were measured using whole-polyp squashes. Cnidocyst nomenclature follows Wang et al. (2009).

– **Temporary**: presence/absence of testes and ovaries.

General and temporary characteristics were observed using a Leica EZ4W stereomicroscope, while cnidome observations were conducted with a Zeiss Axiolab microscope at 1000× magnification and oil inmersion. All measurements were performed using Leica Application Suite (version 3.4.0).

Table 1. Morphological characteristics of *H. vulgaris* collected from freshwater bodies in southeastern Buenos Aires Province. Cnidocyst measurements are expressed as mean ± standard deviation (minimum – maximum). Abbreviations: * = mean and standard deviation not provided by the authors, ✓= stalk present; ✗= stalk absent.

Hydra vulgaris Character measurement	Location			
	La Brava	Los Padres (Deserti and Zamponi, 2011)	Nahuel Rucá	Camet Park
Number of polyps analyzed	12	11	34	19
Column length (mean ± desv st, min – max) (mm)	4.3 ± 0.6 (3.2 – 5.2)	0.8 – 4*	4.5 ± 1.2 (0.6 – 8.4)	3.1 ± 0.9 (1.7 – 5.2)
Stalk	✗	✗	✗	✗
Number of tentacles	5 – 8	5 - 7	5 – 7	6 - 8
Frequent number of tentacles (mode)	7	6	6	6
Relative length of tentacles	¾ or more	¾ or more	¾ or more	¾ or more
Frequent tentacular growth pattern	discontinuous	discontinuous	discontinuous	discontinuous
Stenotele width (µm)	10.5 ± 1.3 (7.5 – 15)	11.75 ± 0.8 (6 – 20)	9 ± 1.6 (4 – 15)	10 ± 1.2 (4 – 14)
Stenotele length (µm)	13 ± 1.5 (9.5 – 17.5)	15.5 ± 0.4 (10 – 30)	11.5 ± 1.8 (5 – 18)	12.5 ± 1.4 (9 – 14)
Holotrichous isorhiza width (µm)	4.5 ± 0.5 (3.5 – 6)	5.45 ± 0.3 (4 – 7)	4 ± 0.5 (2.5 – 6)	4.5 ± 0.6 (3 – 6)
Holotrichous isorhiza length (µm)	10.5 ± 0.8 (8 – 12.5)	12 ± 0.6 (9 – 14)	10 ± 0.9 (6.5 – 13.5)	10 ± 0.8 (8 – 12.5)
Morphotypes	I	I	III	I
Thick filament turns	3 or 4, more or less oblique	3 or 4, generally oblique	3 or 4, more or less oblique	3 or 4, more or less oblique
Desmoneme width (µm)	5 ± 0.6 (3.5 – 6.5)	6 ± 0.4 (4 – 8)	4.5 ± 0.5 (2 – 7)	5.5 ± 0.6 (2.5 – 6)
Desmoneme length (µm)	7 ± 0.65 (5.5 – 8.5)	8 ± 0.7 (8 – 12)	6.5 ± 0.7 (2.5 – 8.5)	6.5 ± 0.7 (4 – 7)
Atrichous isorhiza width (µm)	4 ± 0.4 (3 – 5)	5 ± 0.4 (3 – 8)	3.5 ± 0.5 (1.5 – 5)	3 ± 0.5 (2 – 4.5)
Atrichous isorhiza length (µm)	8 ± 0.8 (4.5 – 9.5)	8 ± 0.9 (5 -13)	7.5 ± 0.8 (2.5 – 10)	8 ± 0.75 (3 – 10)

Table 2. Morphological characteristics of *H. viridissima* collected from freshwater bodies in southeastern Buenos Aires Province. Cnidocyst measurements are expressed as mean ± standard deviation (minimum – maximum). Abbreviations: ✓= stalk present; ✗= stalk absent.

Hydra viridissima Character measurement	Location		
	Los Padres	Nahuel Rucá	Camet Park
Number of polyps analyzed	18	22	12
Column length (mean ± desv st, min-max) (mm)	2.85 ± 0.9 (1.8 – 3.1)	1.1 ± 0.9 (0.6 – 2.9)	2.9 ± 0.8 (1.2 – 3.5)
Stalk	✗	✗	✗
Number of tentacles	5 - 6	6 - 8	6 - 10
Frequent number of tentacles (mode)	5	7	8
Relative length of tentacles	half of the column	half of the column	half of the column or more
Frequent tentacular growth pattern	–	simultaneous	simultaneous
Stenotele width (μm)	5.5 ± 0.5 (5 – 7)	5 ± 0.5 (4 – 6)	6 ± 0.4 (5 – 7)
Stenotele length (μm)	7 ± 0.7 (6 – 9)	6.6 ± 0.5 (5 – 7.5)	7 ± 0.4 (6.5 – 8.5)
Holotrichous isorhiza width (μm)	2.5 ± 0.5 (2 – 5)	3 ± 0.4 (3 – 4)	3 ± 0.3 (2.5 – 4)
Holotrichous isorhiza length (μm)	9.5 ± 0.7 (8 – 10.5)	9 ± 0.7 (7.5 – 10)	10 ± 0.6 (8 – 11)
Morphotypes	II	II	I
Thick filament turns	3 or 4, oblique	3 or 4, oblique	3, oblique
Desmoneme width (μm)	3 ± 0.4 (2 – 3.5)	3 ± 0.4 (2 – 3.5)	3 ± 0.3 (2.5 – 4)
Desmoneme length (μm)	4 ± 0.4 (3.5 – 5)	4 ± 0.45 (3 – 5)	4 ± 0.3 (4 – 5)
Atrichous isorhiza width (μm)	2 ± 0.3 (2 – 3)	2.5 ± 0.4 (2 – 3.5)	2 ± 0.2 (2 – 3)
Atrichous isorhiza length (μm)	5 ± 0.3 (4 – 5)	4.5 ± 0.4 (3.5 – 5)	5 ± 0.3 (4.5 – 6)

Table 3. Morphological characteristics of *H. vulgaris pedunculata* collected from freshwater bodies in southeastern Buenos Aires Province. Cnidocyst measurements are expressed as mean ± standard deviation (minimum – maximum). Abbreviations: * = mean and standard deviation not provided by the authors, ** standard deviation not provided by the authors, ✓= stalk present; ✗= stalk absent.

Hydra vulgaris pedunculata Character measurement	Location		
	La Brava	Los Padres (Deserti et al., 2011)	Nahuel Rucá
Number of polyps analyzed	17	11	22
Column length (mean ± desv st, min-max) (mm)	2.2 ± 0.5 (2.4 – 2.7)	1.4 – 4.3*	2.8 ± 1.1 (0.6 – 6.1)
Stalk	✓	✓	✓
Number of tentacles	6 - 8	5 - 6	6 – 7
Frequent number of tentacles (mode)	7	6	6
Relative length of tentacles	¾	¾ or more	¾
Frequent tentacular growth pattern	discontinuous	discontinuous	discontinuous
Stenotele width (μm)	10.75 ± 1.7 (7.5 – 15)	11.5** (6 – 15)	9.6 ± 1.6 (7 – 14)
Stenotele length (μm)	13.75 ± 1.9 (10 – 17.5)	14.5** (10 – 18)	12 ± 1.7 (9 – 16.5)
Holotrichous isorhiza width (μm)	4.5 ± 0.4 (3.5 – 5)	5.5** (4 – 7)	4 ± 0.4 (3 – 5)
Holotrichous isorhiza length (μm)	11 ± 0.8 (8 – 12.5)	12** (11 – 14)	10 ± 0.8 (4.5 – 12)
Morphotypes	I	I	I
Thick filament turns	3 or 4, more or less oblique	3 or 4, generally oblique	3 or 4, more or less oblique
Desmoneme width (μm)	5 ± 0.4 (4 – 5.5)	6** (4 – 8)	4.5 ± 0.5 (3 – 6)
Desmoneme length (μm)	6.5± 0.4 (6 – 7)	9** (6 – 12)	6.5 ± 0.55 (5 – 8)
Atrichous isorhiza width (μm)	4 ± 0.3 (4 – 5)	5** (3 – 8)	3.5 ± 0.5 (2.5 – 5)
Atrichous isorhiza length (μm)	8± 0.8 (6 – 9)	9** (5 – 13)	7.5 ± 0.6 (6 – 9.5)

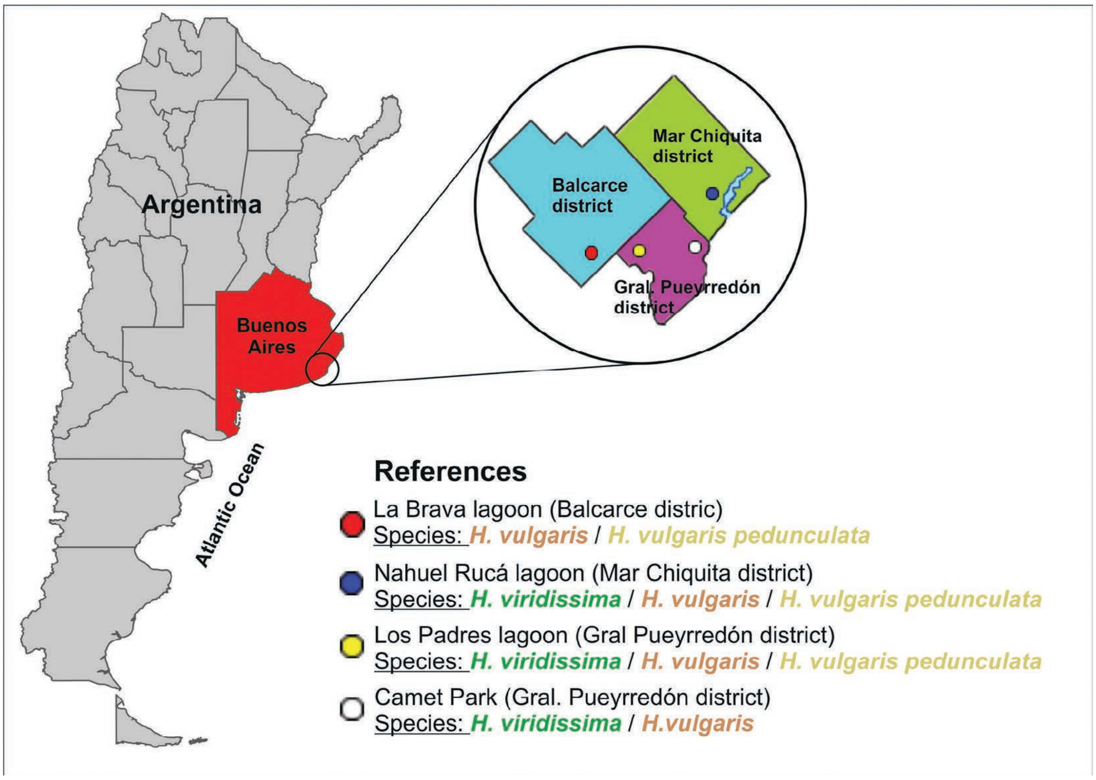

Figure 1. Sampling sites of *H. viridissima*, *H. vulgaris*, and *H. vulgaris pedunculata* in freshwater bodies of southeastern Buenos Aires Province, Argentina.

RESULTS

The following species were collected from the four sampling sites (Figure 1):

– *Hydra viridissima* Pallas, 1766: Camet Park and Los Padres and Nahuel Rucá lagoons.

– *Hydra vulgaris* Pallas, 1766: Camet Park and Los Padres, Nahuel Rucá and La Brava lagoons.

– *Hydra vulgaris pedunculata* Deserti, Zamponi & Escalante, 2011: Los Padres, Nahuel Rucá and La Brava lagoons.

Table 1-3 summarizes the morphological characteristics of the specimens collected at each sampling site (Figure 2). The morphological data of *H. vulgaris* and *H. vulgaris pedunculata* for the Los Padres lagoon correspond to the work of Deserti and Zamponi (2011) and Deserti et al. (2011). However, they are included in the table for comparative purposes. These species were found in later years, maintaining the same morphological characteristics of those mentioned first reports.

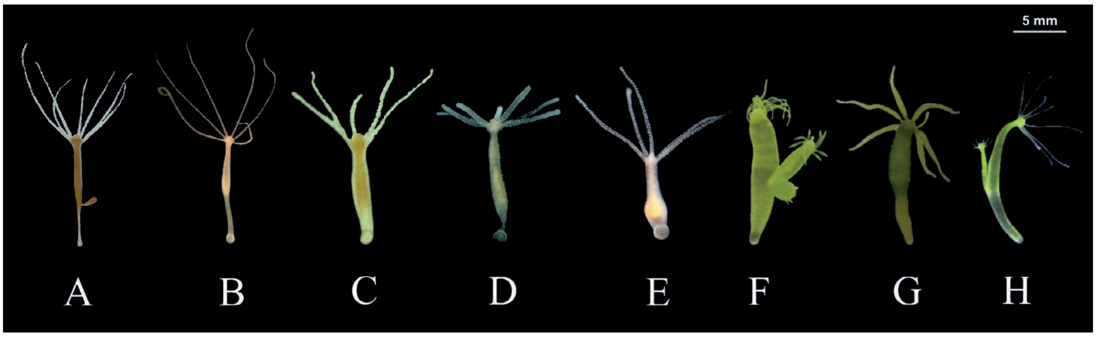

Figure 2. *Hydra* polyps. **A** and **B**: *H. vulgaris pedunculata* from La Brava and Nahuel Rucá respectively; **C**, **D** and **E**: *H. vulgaris* from Nahuel Rucá, La Brava and Camet Park, respectively, and **F**, **G** and **H**: *H. viridissima* from Los Padres, Nahuel Rucá and Camet Park respectively.

Sexual characters.— In the case of *H. viridissima*, no sexual structures could be observed for the populations from Los Padres and Nahuel Rucá, while in the population extracted from Parque Camet, only males could be observed. For *H. vulgaris*, the populations from La Brava presented separate sexes, from Nahuel Rucá only males and in Parque Camet one specimen were hermaphroditic. For the specimens from the Los Padres lagoon, Deserti and Zamponi (2011) did not record sexual characteristics. The two populations of *H. vulgaris pedunculata* from La Brava and Nahuel Rucá did not show sexual characteristics, like the population collected in Los Padres lagoon by Deserti, Zamponi and Escalante (2011), but a sample collected in Laguna Los Padres, after the publication of its discovery, showed some specimens with only testes.

Holotrichous isorhiza morphotypes (Figure 3): *H. viridissima* from Los Padres and Nahuel Rucá lagoons exhibited two morphotypes of holotrichous isorhizas (Deserti et al., 2010); the most frequent Morphotype I with an

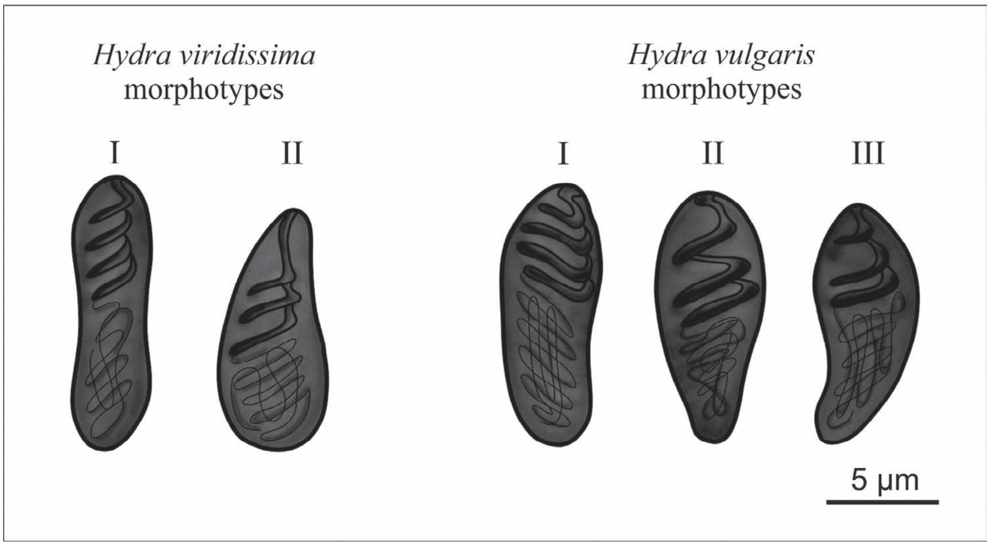

Figure 3. *H. viridissima* and *H. vulgaris* holotrichous isorhiza morphotypes

elongated, banana-shaped form, and Morphotype II with a more pointed distal end. Both morphotypes displayed three to four thick, obliquely arranged coils. The specimens collected in Camet Park only exhibited Morphotype II, with up to three oblique whorls of the thick filament.

H. vulgaris specimens from La Brava Lagoon and Parque Camet exhibited the classic and most frequent Morphotype I, characterized by a paramecium-like or shoe-sole shape, with three to four thick coils arranged in a more or less oblique orientation. Deserti and Zamponi (2011) reported the same Morphotype I in *H. vulgaris* specimens collected from the Los Padres Lagoon. The specimens collected from Nahuel Rucá Lagoon exhibited three distinct morphotypes; Morphotype I corresponded to the form previously described for this species; Morphotype II featured a rounded and wider distal portion with a more pointed proximal region; and Morphotype III showed the opposite configuration, namely, a more pointed distal end and a rounder, wider proximal portion. All three morphotypes exhibited three to four thick coils arranged in a more or less oblique orientation.

Specimens of *H. vulgaris pedunculata* from La Brava and Nahuel Rucá lagoons exhibited Morphotype I, as previously described for *H. vulgaris*. This same morphotype was also reported by Deserti, Zamponi and Escalante (2011) for this subspecies, collected from Los Padres Lagoon.

DISCUSSION AND CONCLUSIONS

Although interest in cnidarians has grown in recent years, there is little information on those restricted to freshwater. Some problems in sampling techniques and the preservation of biological material mean that this zoological group is not adequately detected in aquatic biodiversity surveys, resulting in their exclusion from many species inventories. In Argentina, there is a significant information gap between 1968, when the green *H. plagiodesmica* was first reported, and 2011, when research efforts resumed, leading to the first published record of *H. vulgaris* (Deserti and Zamponi, 2011). This prolonged stagnation in research has hindered the advancement of knowledge regarding the ecological, biological, and genomic characteristics of local species, particularly in the context of emerging analytical tools. Consequently, critical aspects such as the taxonomy and distribution of Argentine *Hydra* species remain under continuous revision (Figure 4).

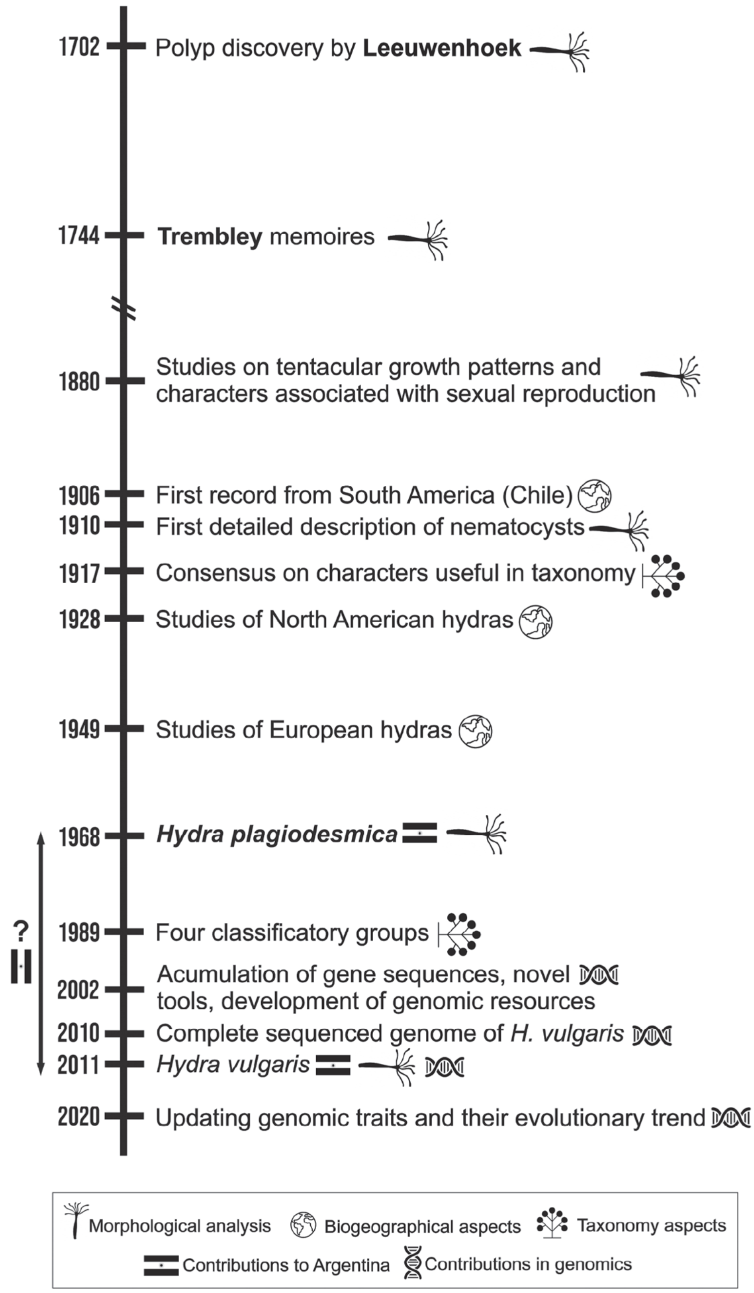

Figure 4. Chronological milestones in *Hydra* research, highlighting key contributions in morphology, taxonomy, biogeography, genomics, and studies conducted in or related to Argentina.

The four groups (*viridissima*, *vulgaris*, *oligactis* and *braueri*) originally differentiated on the basis of morphological characters, were subsequently confirmed by molecular phylogenetic analysis (Hemmrich, Anokhin, Zacharias and Bosch, 2007; Kawaida, Shimizu, Fujisawa, Tachida and Kobayakawa, 2010; Schwentner and Bosch, 2015). These studies identifying several monophyletic clades within *Hydra* and within its four groups.

Schwentner and Bosch (2015) acknowledge that many lineages can be considered phylogenetically distinct species (Mishler & Theriot, 2000) and not grouped under the same name (as is especially the case for *H. viridissima* and *H. vulgaris*). However, have also shown that several individuals that had been identified as distinct species within, for example, the *vulgaris* group, clearly belong to the same species, suggesting synonymy between them.

The *vulgaris* group is complex. Within it, there are very similar species that can only be distinguished based on their geographic origin. Thus, the species of this group are generally dioecious; however, hermaphroditic specimens and also those with sex reversal have been reported (Lenhoff, 1983). Various morphotypes have also been found for their holotrichous isorhiza, different sizes in their desmonemes, and diverse patterns of tentacle growth. Martinez et al. (2010) state that the total number of species in this genus depends on how much variation is accepted within the species of this group. For example, the subspecies *Hydra vulgaris pedunculata* (Deserti et al., 2011) is clearly distinguishable from other *Hydra vulgaris* specimens by the presence of a permanent and conspicuous translucent stalk. However, these morphological variations are not reflected in differences at the molecular level, but rather reflect only a certain phenotypic plasticity. This case exemplifies the aforementioned statement by Schwentner and Bosch (2015), that some populations with distinct morphological characteristics still belong to the same species. The work of Deserti, Durán-Fuentes, Maronna, Morandini, Acuña and Stampar (2025), addresses the same conclusions for *Hydra* specimens collected in different bodies of the state of São Paulo in Brazil.

It is not surprising to find *H. vulgaris* specimens with intraspecific variations in the water bodies of southeastern Buenos Aires Province. These morphological differences could be linked to the limnological characteristics of each water body, ranging from more conserved waters, such as Nahuel Rucá, to La Brava, Los Padres, and Parque Camet, in increasing order of anthropogenic impact (Deserti, 2016).

Multiple experiments have demonstrated the morphological responses of these organisms to stimuli such as temperature, light, pH (Burnett, 1973, Lenhoff, 1983; Bosch, Krylow, Bode and Steele, 1988; Bossert and Galliot, 2012), and even to different chemical compounds present in water bodies from agricultural activities (Demetrio, Rossini, Bonetto and Ronco, 2012) and other emerging pollutants such as pharmaceuticals and personal care products (Pascoe, Karntanut and Müller, 2003; Quinn, Gagné and Blaise, 2008). We still don't know for sure how the combination of these factors can affect the morphology of organisms so sensitive to changes in the aquatic environment, nor how adaptability to these anatomical changes can be maintained over time and even transferred to future generations of polyps.

It is evident that morphological approaches in this genus constitute a key complement that must accompany molecular phylogenetic studies, which, ultimately, lead to a clearer distinction between intraspecific and interspecific variability.

Sexual reproduction in hydras is considered a response to stress conditions and is primarily initiated by environmental factors such as changes in temperature, starvation, light intensity, photoperiod, among others (Loomis, 1959; Fukuhori, Kitano and Kimura, 2005). Temperature is the most important factor, and consequently, hydra species are divided into "warm crisis" and "cold crisis" species (Burnett, 1973). *H. vulgaris* is an interesting species in terms of its sexual characteristics. Both decreasing and increasing temperature stimulate gonadal development. Males and hermaphrodites appear with increasing temperature, while females appear exclusively with decreasing temperature (Kaliszewicz and Lipińska, 2011). However, it has been observed that this species also changes to its sexual form spontaneously and without the environmental factors necessary for sexual induction (Tardent, 1968). The combination of temperature and food is also important. With greater food availability, a higher proportion of hermaphrodites is observed compared to males and females, reinforcing the idea that hermaphroditism has a higher energetic cost. This relates to the observations of Kaliszewicz (2011) for *H. viridissima*, in which sexual individuals, especially hermaphrodites, were the largest. However, due to its symbiotic nature, this condition of hermaphroditism is not as strongly linked to food availability as it is in *H. vulgaris*. (Kaliszewicz and Lipińska, 2011).

To assess the relationship between observed sexual forms and associated environmental parameters that potentially influence these patterns, more in-depth studies are required. Such investigations should include, for example, analyses of seasonality, photoperiod, and the structure of local communities that may constitute the trophic basis of *Hydra*. These variables, among others, were beyond the scope of this work. However, documenting the sexual forms present in each population remains valuable, as it provides a necessary basis for future ecological and experimental work. Given the considerable reproductive plasticity described within the genus, recording these patterns in natural contexts contributes to understanding the extent and variability of reproductive strategies under natural conditions and can help identify sites of particular interest for future research.

The scarcity of records and systematic studies on freshwater cnidarians for Argentina limits their adequate inclusion in aquatic biodiversity surveys. In this context, the data presented here constitute a useful contribution to future research aimed at resolving outstanding questions regarding the diversity and distribution of *Hydra* species present in freshwater environments in South America.

ACKNOWLEDGMENTS

We thank the staff of the Parasitology Laboratory and the Limnology Laboratory (UNMdP) for facilitating transportation to the study site.

FINANCING

This work was funded by PICT 2021-I-INVI-00577 to M. Irene Deserti.

CONTRIBUTION STATEMENT

María I. Deserti: Writing (review and editing) original draft, supervision, methodology, investigation, formal analysis, data curation, conceptualization. **Fabián H. Acuña**: writing and correction original draft, supervision, formal analysis, conceptualization.

DECLARATION OF COMPETING INTEREST

No potential conflict of interest was reported by the authors.

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