Studies on vegetative production of *Potamogeton illinoensis* Morong in southern Argentina

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**Key words:** aquatic weeds, *Potamogeton illinoensis*, growth characteristics, survival strategies

**Abstract**

*Potamogeton illinoensis* Morong is a major submerged weed invading irrigation channels in the Lower Valley of the Rio Negro, near Viedma, Argentina. Studies on morphology and growth characteristics of this species were conducted in an outdoor tank from August 1993 to May 1994 with the objective of increasing the knowledge of its ecology order to adjust control measures. The maximum aboveground biomass was reached in April, with a subsequent decrease to May when the water supply was cut off. Belowground biomass comprised two kinds of rhizomes. The first group (Rhizomes I) was produced from the beginning of the annual cycle causing both lateral shoots and new rhizomes I production. The second group (Rhizomes II) was distinguished as an enlargement of the extremes of rhizomes I from mid-November, producing only short overwintering sprouts. Plant parts production (DW in g/plant) in the first cycle was: 27.2 g leaves; 11.9 g stems; 17.4 g rhizomes I and 8.1 g rhizomes II. Vegetative propagation appeared to be an important survival strategy in this species. During the 3–4 month period without water only rhizomes with underground overwintering sprouts survive in the dry sediment.

**Introduction**

*Potamogeton illinoensis* Morong is an aquatic macrophyte that has developed profuse growths in irrigation channels of the Lower Valley of the Rio Negro in southern Argentina. Impeding water movement, its development considerably reduces the water supply for agriculture and increases the irrigation network management costs.

Little is known about this weed in Argentina (Tur, 1982). Although listed by Pieterse & Murphy (1990) as an aquatic weed, Steward (1990) categorised the species as one which does not cause major weed problems in North America. It is a common lake species in areas such as Florida (e.g. Ewel & Fontaine, 1983). The species is named in the Applied Biochemists Inc. (1976) listing of aquatic weeds. Locally, it is known by the common name of ‘lama’ but until this study it had not even been properly identified in the area.

Plants of *Potamogeton illinoensis* begin growing from the first days of August, when the channels are refilled (Dall’Armellina et al., in press). Then a main shoot develops and, at the same time, two new rhizomes from the third and fourth nodes of the main shoot appear. These rhizomes have buds on alternate nodes over which they produce both a shoot and a new rhizome (branch). Each new rhizome develops like the previous one (Bezic, 1994). Seasonal sampling of natural populations of *Potamogeton illinoensis* shows different kinds of rhizomes (Dall’Armellina et al., in press). Bezic (1994) recognized two different types of rhizomes in this species: (a) Rhizomes I, produced from initial stages in the annual cycle and dying in the next winter, that appear to be structures adapted for colonization, and (b) Rhizomes II, that appear at the beginning of the summer as an enlargement of the Rhizome I extremes, probably by accumulation of carbohydrate reserves. They are whiter and bigger than the previous type developing one short belowground overwintering sprout at alternate nodes. Only Rhizomes II survive the dry season and initiate the next sprouting (Bezic, 1994). Aboveground parts are 92–93% represented...
by stems and submerged leaves (Bezic, 1994). Floating leaves have never been observed on *P. illinoensis* plants in the study area. Inflorescences are terminal spikes as in other *Potamogeton* species (Sculthorpe, 1967).

The objective of the study was to understand the seasonal growth and development of this macrophyte, in order to improve the efficacy of weed control measures directed against it.

**Materials and methods**

The study was performed in a concrete-lined 2 m deep circular tank, 50 m in diameter, between August 1993 and May 1994 at the IDEVI-INTA Experimental Station (40°48’ S; 63°05’ W; 4 m above sea level; annual mean temperature 14 °C) near Viedma, Rio Negro province, Argentina. The tank was topped up weekly with water, piped from the irrigation supply (derived from the Rio Negro). Dissolved oxygen concentration ranged between 8.6–14.6 mg liter⁻¹, mean electrical conductivity was 0.18 μS cm⁻¹ and midday water temperature ranged between 10.3–25.4 °C during the study period.

Plants were grown in glass aquaria from pieces of rhizome (mean ± standard error: 0.8 ± 0.01 g fresh weight) with an overwintering sprout, collected from the bottom of the main irrigation channel in July 1993 and maintained in a refrigerator until 6 August. After 17 days growth in the laboratory (water mean temperature 18 °C; light intensity 100 μE m⁻² s⁻¹; 16 h illumination per day) the plants were transferred to 54 wooden boxes (0.37 x 0.51 x 0.19 m), internally lined with a black plastic sheet and filled with soil free from propagules of other aquatic macrophytes. Three plants were placed in each box. Plant development was followed for a further 265 days. On each sampling occasion, 3 boxes were selected at random and the 9 plants which they contained were harvested. In the laboratory the plants were washed with clean water and separated into their main constituent parts (leaves, stems, rhizomes I and II), stem and rhizome length was measured, and then dried for 24 hours at 105 °C. Dry weight (DW) was taken with a 0.0001 g precision balance at the first stages and with a 0.01 g precision balance during the middle and at the end of the growing season. Biomass measurement and analysis were carried out following the recommendations of Madsen (1993). Relative growth rate (RGR) was calculated for total plant biomass over the main period of growth (measured at t1, 105 days after start and t2, 282 days after start). Although data were collected for other organs, we present here the results for leaves, stems, and rhizomes: these accounted for >90% of total plant weight in all specimens.

**Results**

Visible plant development from an overwintering sprout began when this was submerged in water. A main shoot then developed which had alternate submerged leaves with ligules. Within the belowground system the only components present were roots and rhizomes.

Rhizome production began at the first developmental stages with the production of two initial rhizomes at the third and fourth main shoot nodes. New rhizomes were produced at alternate nodes of the initial rhizomes together with the formation of lateral shoots (ramets) on the same node. From January (150 days) new rhizomes increased their size giving rise to the second identified type (Rhizomes II). No new rhizomes were produced by these, which only showed overwintering sprouts.

**Plant production**

Although the growing season began during the last days of winter, the main period of growth commenced 105 days after the start (mid-November), (Figures 1 and 2). Thereafter, growth was linear until 239 days, with the exception of rhizomes II that continued their growth until the end of the season, in May 1994. The calculated value of RGR for mean total plant biomass over the main growth period was 0.33 g g⁻¹ d⁻¹.

The average growth rates for leaves and stems are presented in Table 1. The main growth period for Rhizomes I was the same as for leaves and stems, commencing in mid-November, and reaching maximum biomass at the end of April (Table 1). Rhizomes II production did not begin until the first week of January (150 days from start), with the maximum reached in May after 282 days.

Lateral shoots reached a length of almost 40 m per plant in March, with a very rapid increase during February. The same pattern was followed by rhizome I production, reaching a total length of 10 m per plant. Finally, rhizome II length only reached a maximum value of 1.8 m per plant in March (Table 1).