

A CIÊNCIA COMO BASE PARA A MELHOR GESTÃO DE CORTADERIA

RESULTADOS



Mónica Roldão Almeida



RESEARCH ARTICLE

Knowing the invader: increasing knowledge about an invasive plant to improve management

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Pampas grass is an invasive alien plant with negative consequences for ecosystems, human health, and economy. Although diverse aspects of its biology and the ecology have been studied, some information relevant to its management is still missing. We studied the ecological characteristics of seeds and plants relevant to management and habitat restoration, namely morphological and reproductive traits in female and hermaphrodite plants, flower development, seed longevity, and germinability under different conditions. Female and hermaphrodite plants showed significant differences regarding reproductive traits, but not for morphological traits. Female plants are largely responsible for the dispersal of the species, while hermaphrodite plants primarily serve as pollen donors, contributing to off-season allergies. In general, seeds of female plants are mature 3–4 weeks from the onset of flower development and are dispersed by wind until after 4 months, but timings are influenced by weather conditions. The species is very adaptable and can germinate in different soils (85% in fluvisols, 65% in podzols, and 35% in solonchak), water salinities (77 and 75% in freshwater, 28 and 38% in mesohaline, and 7 and 35% in polihaline waters, in laboratory and field, respectively), and moisture conditions (50 and 33% in soaked conditions, and 25 and 80% in moistened conditions, in laboratory and field, respectively). Seeds lack dormancy, are short-lived (up to 1 year in the field and 3 years in optimal storage conditions), and are easily destroyed at 40°C temperatures in dark conditions. Implications of these findings for the management of the species are discussed.

Key words: biological invasion, *Cortaderia selloana*, female and hermaphrodite plants, invasive plants management, pampas grass, seed longevity and germination

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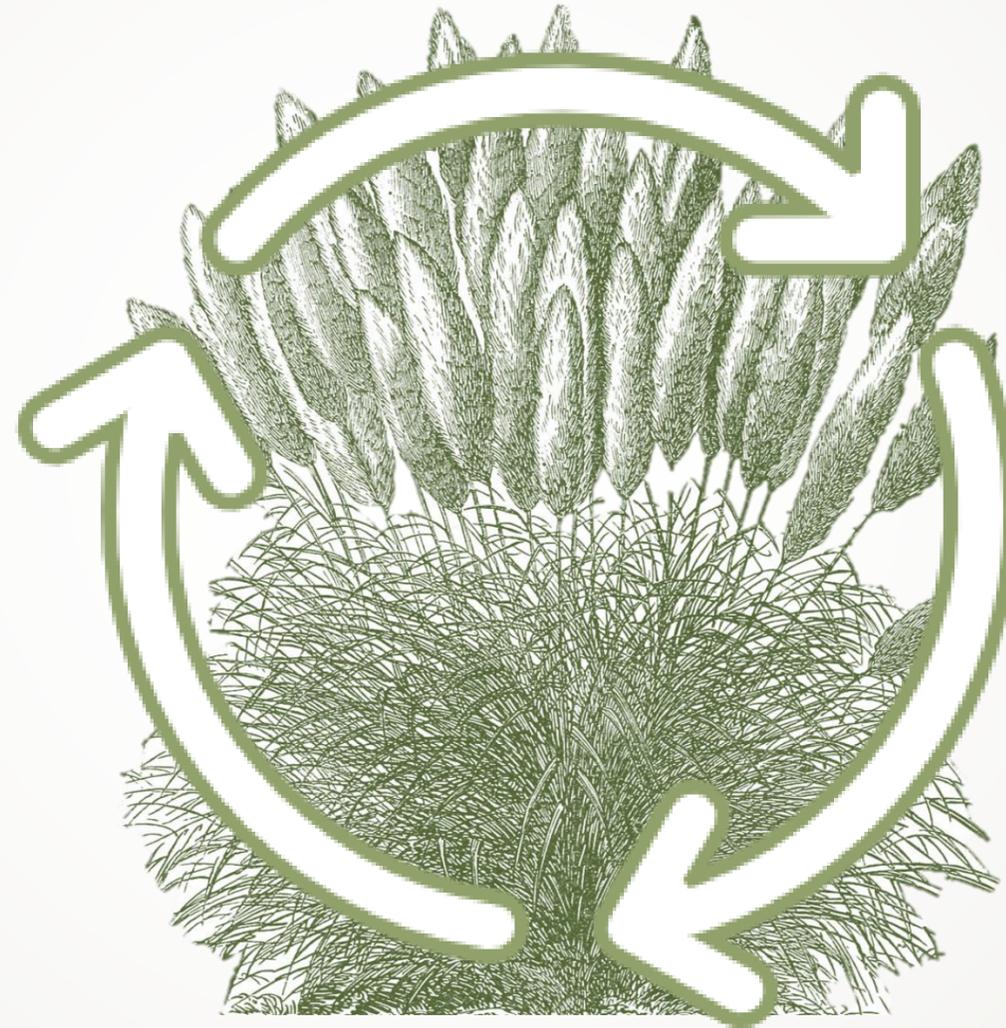
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Objetivos

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CONHECIMENTO



RESTAURO

GESTÃO



Objetivos

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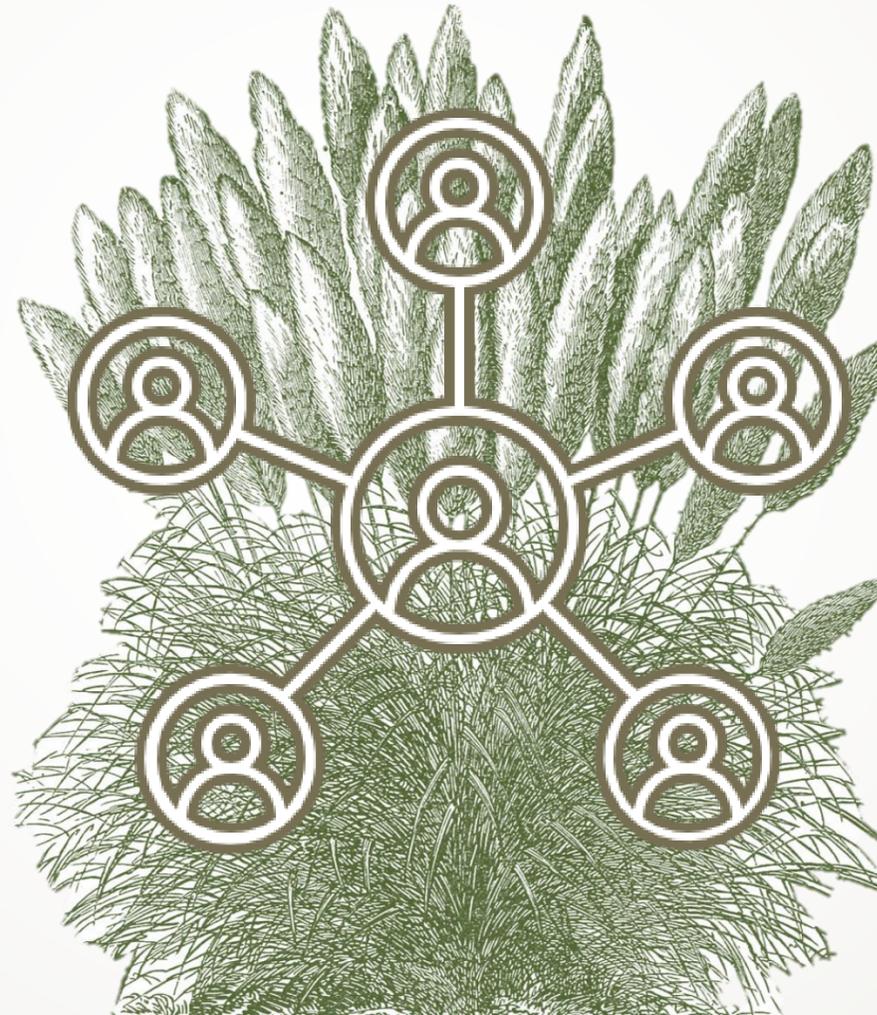
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Resistência à
“compostagem”

Longevidade do
banco de
sementes

Estruturas
vegetativas e
reprodutoras



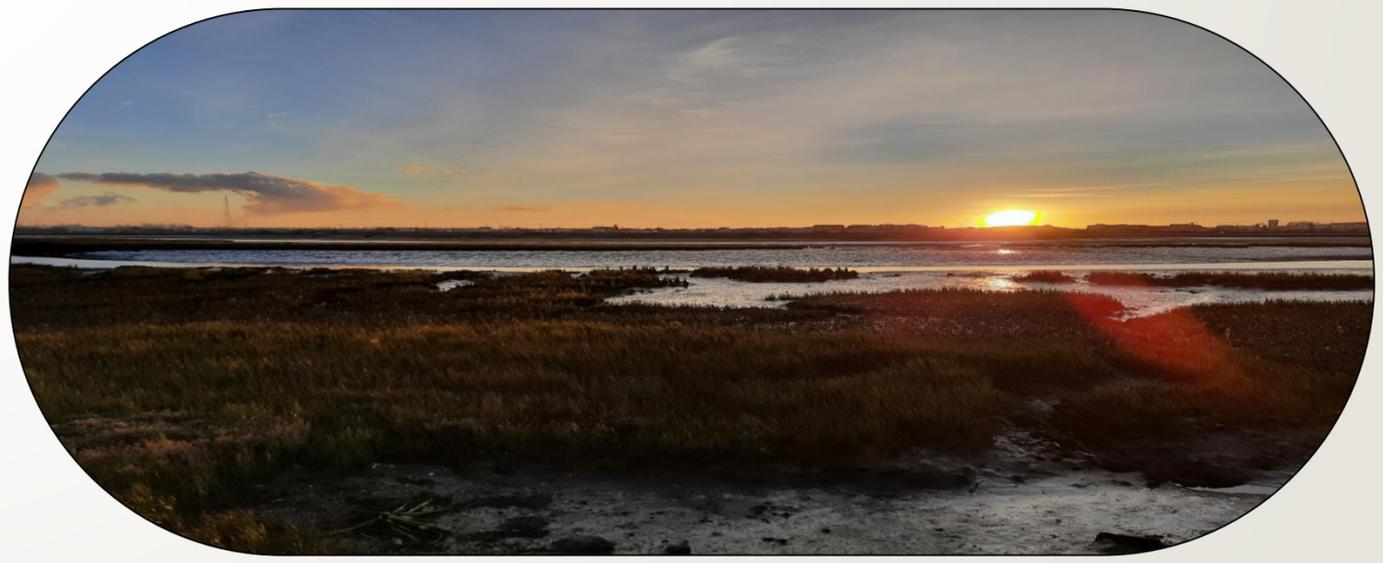
Desenvolvimento
das flores
femininas

Germinação das
sementes em
diferentes condições



Área de estudo

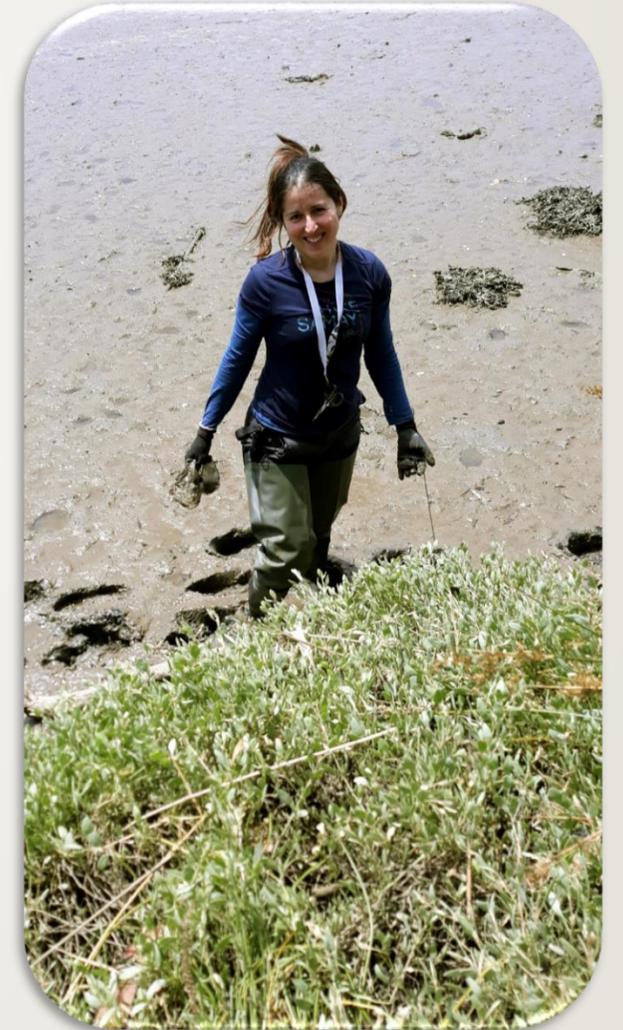
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Metodologia

doi: 10.1111/rec.14175

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Resultados - morfologia

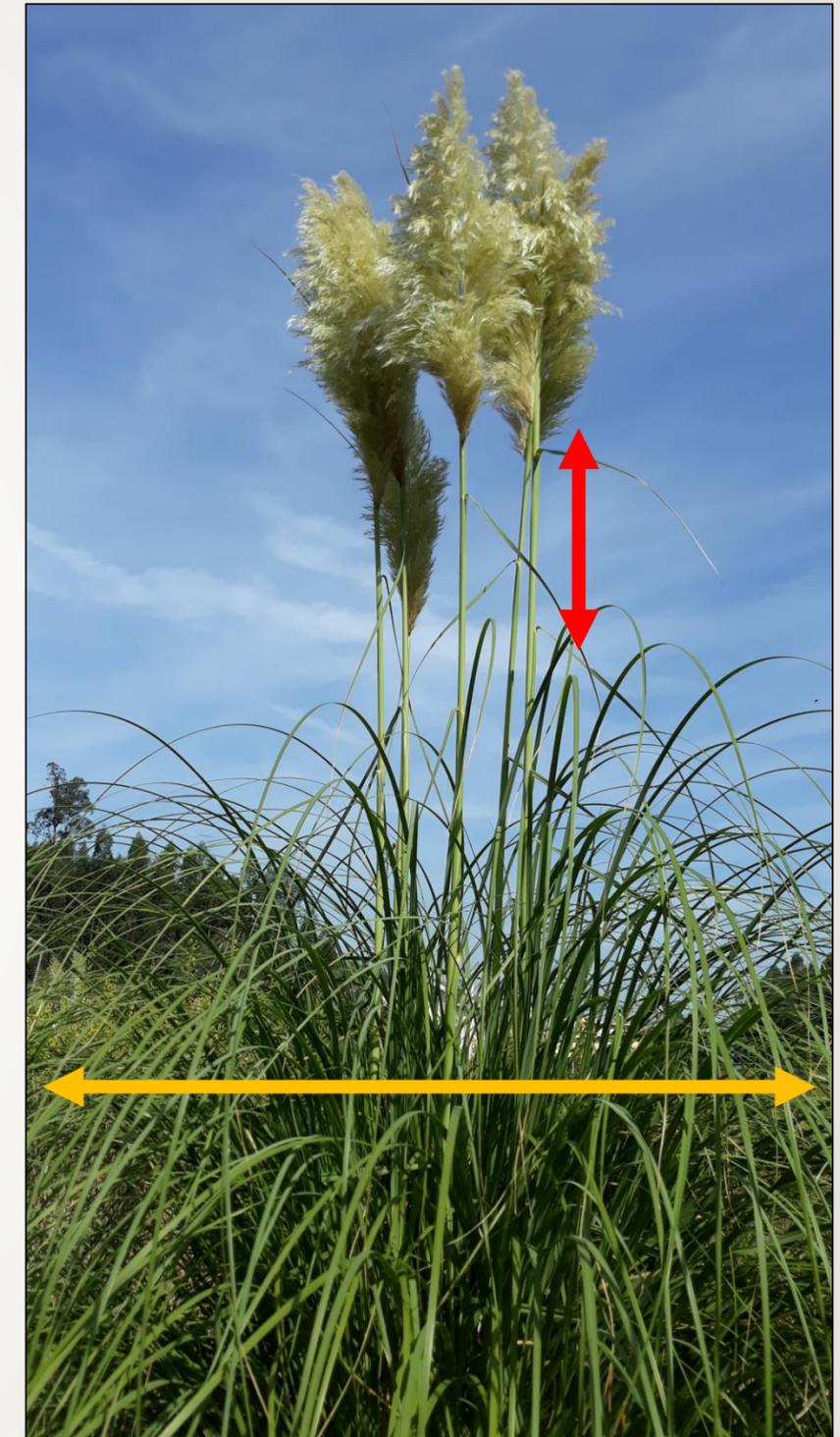
Table 1. Morphological parameters assessed (mean \pm SE) in *Cortaderia selloana* female and hermaphrodite plants, isolated or in clusters, in Coimbra, Portugal. Numbers in parentheses in the first column refer to the number of plants measured. The shaded rows correspond to the totals.

	Plant height (cm)	Leaf height (cm)	Height above tussock (cm)	Plant diameter (cm)	Number of inflorescences	Inflorescence length (cm)
Isolated hermaphrodites (50)	224 (\pm 7)	133 (\pm 5)	91 (\pm 5)	208 (\pm 6)	19 (\pm 2)	45 (\pm 2)
Isolated females (50)	225 (\pm 10)	142 (\pm 5)	83 (\pm 7)	211 (\pm 9)	23 (\pm 3)	49 (\pm 2)
Clustered hermaphrodites (50)	261 (\pm 8)	148 (\pm 6)	113 (\pm 6)	146 (\pm 8)	15 (\pm 2)	50 (\pm 2)
Clustered females (50)	267 (\pm 6)	151 (\pm 5)	116 (\pm 5)	150 (\pm 7)	16 (\pm 2)	52 (\pm 1)
Total isolated (100)	224 (\pm 6)	137 (\pm 3)	87 (\pm 5)	210 (\pm 5)	21 (\pm 2)	47 (\pm 1)
Total clustered (100)	264 (\pm 5)	149 (\pm 4)	115 (\pm 4)	148 (\pm 5)	16 (\pm 2)	51 (\pm 1)
Total hermaphrodites (100)	243 (\pm 5)	140 (\pm 4)	102 (\pm 4)	177 (\pm 6)	17 (\pm 1)	48 (\pm 1)
Total females (100)	246 (\pm 6)	147 (\pm 4)	99 (\pm 5)	181 (\pm 6)	20 (\pm 2)	51 (\pm 1)
Total plants (200)	244 (\pm 4)	143 (\pm 3)	101 (\pm 3)	179 (\pm 4)	19 (\pm 1)	49 (\pm 1)

isoladas



agrupadas



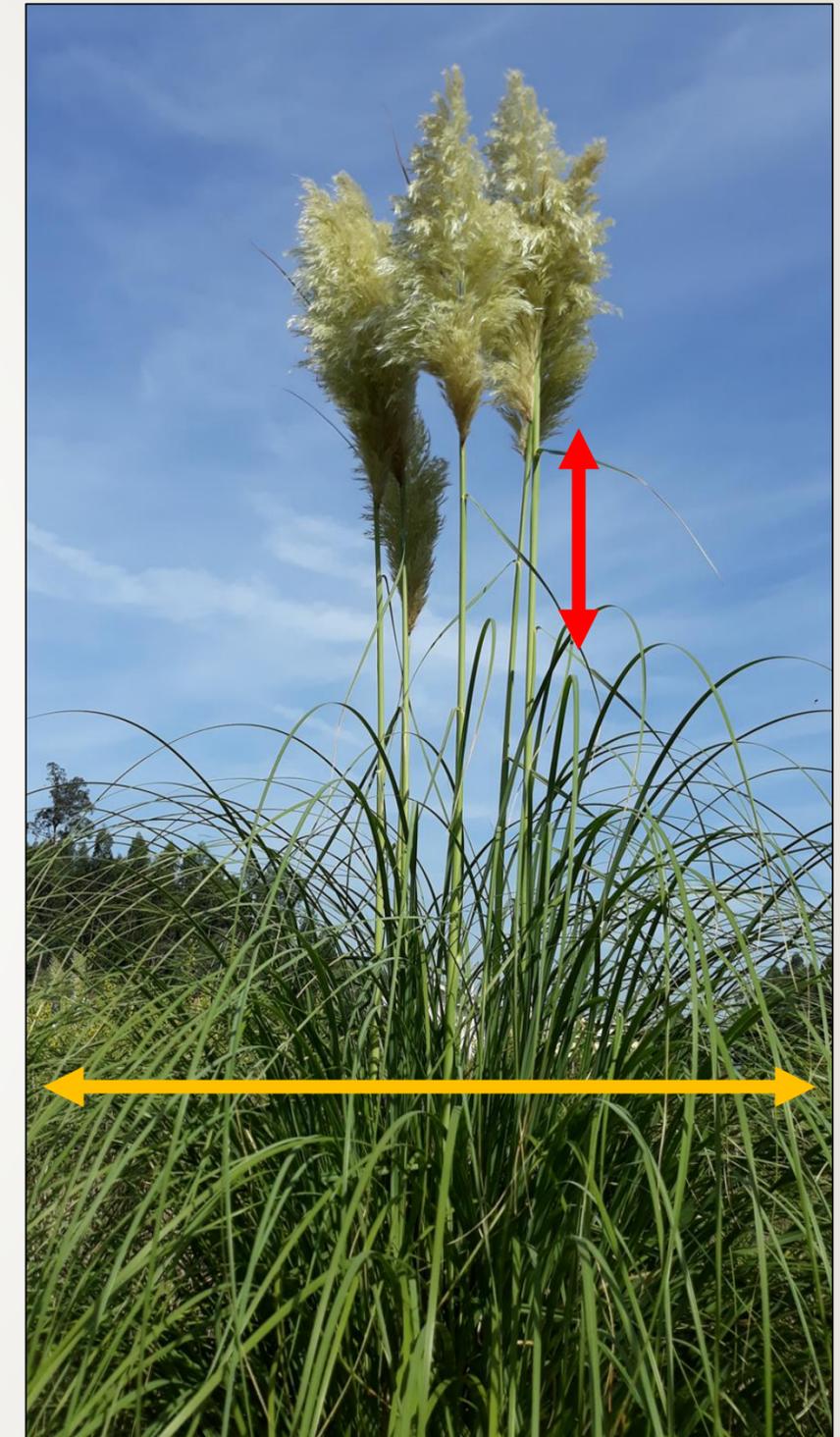
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Não há diferenças entre femininas e hermafroditas

Há diferenças entre isoladas e agrupadas



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Há diferenças entre isoladas e agrupadas

Distinção entre *C. selloana* e *C. jubata*



Resultados - flores

Table 2. Types of flowers of *Cortaderia selloana* female and hermaphrodite plants, collected in October 2019, Coimbra, Portugal. Ten thousand flowers were analyzed for each sex. GR refers to the germination rate.

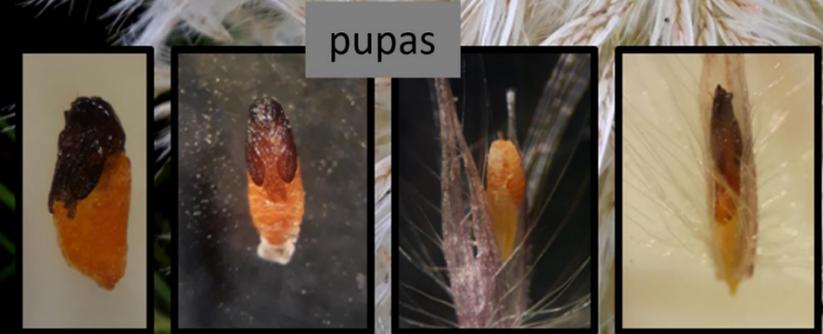
	Female plants	Hermaphrodite plants
Empty flowers	0%	81%
Flowers with senescent stamens	0%	18%
Flowers with mature seeds	49% (78% GR)	1% (51% GR)
Flowers with aborted and rotten seeds	38%	
Flowers with <i>Spanolepis selloanae</i>	13%	0%



Diferenças entre femininas e hermafroditas

Presença de *S. selloanae* em Portugal continental

Penacho parasitado por *Spanolepis selloanae*



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Resultados - desenvolvimento flores femininas

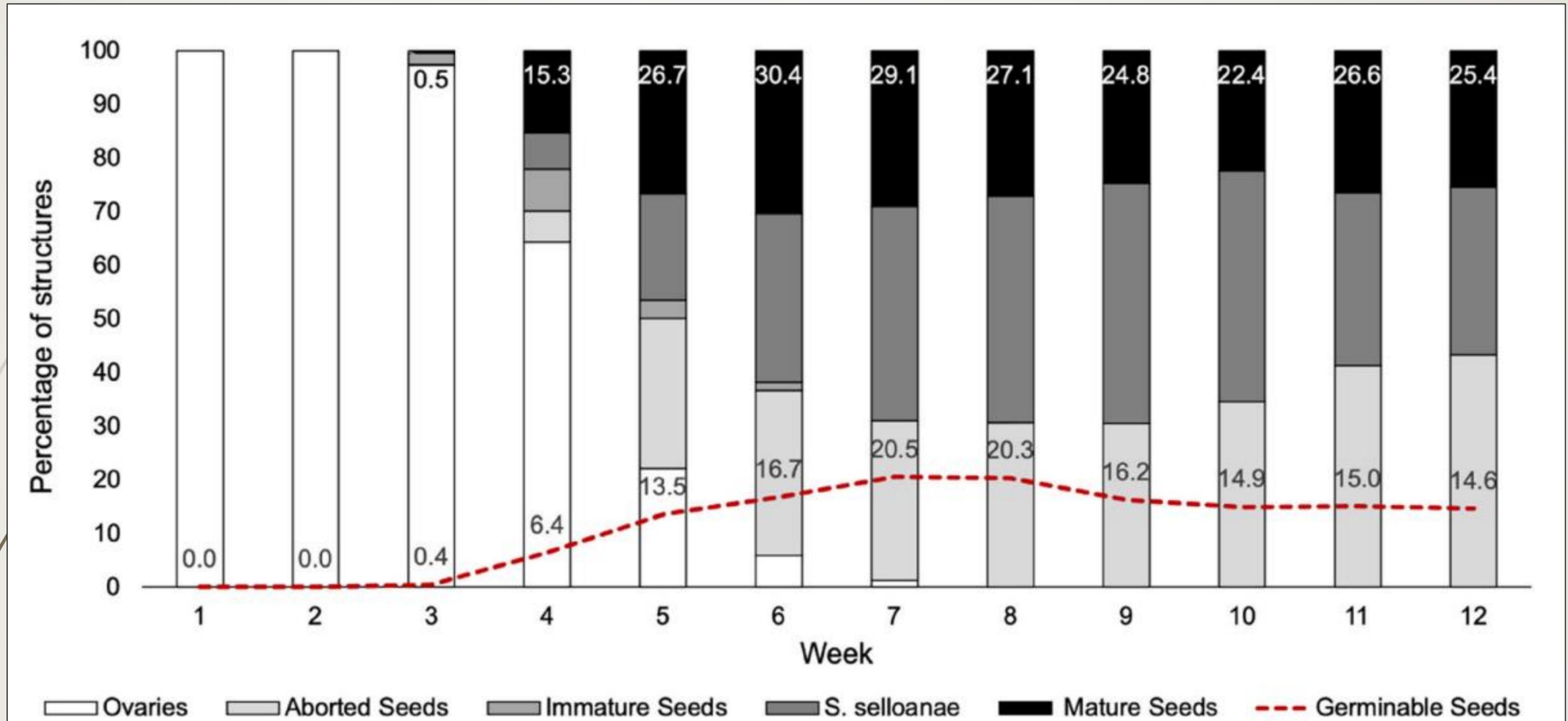


Figure 2. Maturation of *Cortaderia selloana* female flowers over 12 weeks in a population in Coimbra, Portugal. Seeds were considered mature (black part of the bar, with respective percentages written in white) when filled and intact (undamaged). Dashed line in red is the percentage of germinable seeds (percentages in black close to the line), that is, the mature seeds that germinated compared with the total number of flowers analyzed each week. Monitoring started on 23 August 2021. $n = 9600$ flowers.

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Resultados - desenvolvimento flores femininas

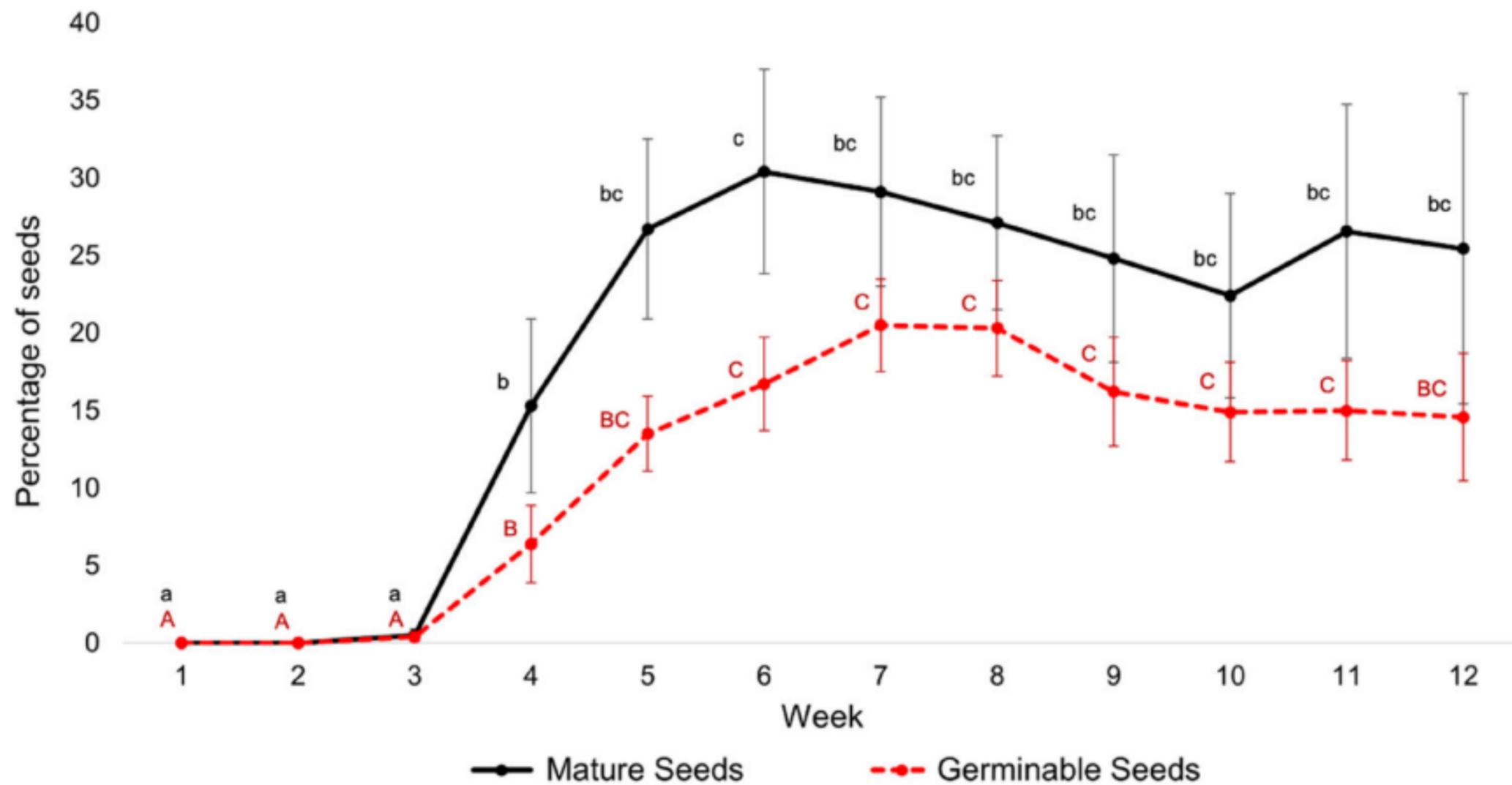


Figure 3. Percentage (mean \pm SE) of *Cortaderia selloana* mature (black solid line) and germinable (red dashed line) seeds over 12 weeks in a population in Coimbra, Portugal. Values with different letters denote significant differences (Dunn's test: $p < 0.05$) for mature (lowercase) and germinable (uppercase) seeds. $n = 2180$ seeds.



Figueira da Foz – água salobra e água salgada, solonchak (solo salino)
Mata Nacional do Choupal – água doce, fluvisol (solo jovem com matéria orgânica)
ESAC – água doce, podzol (solo ácido)

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Resultados - germinação das sementes em lab.

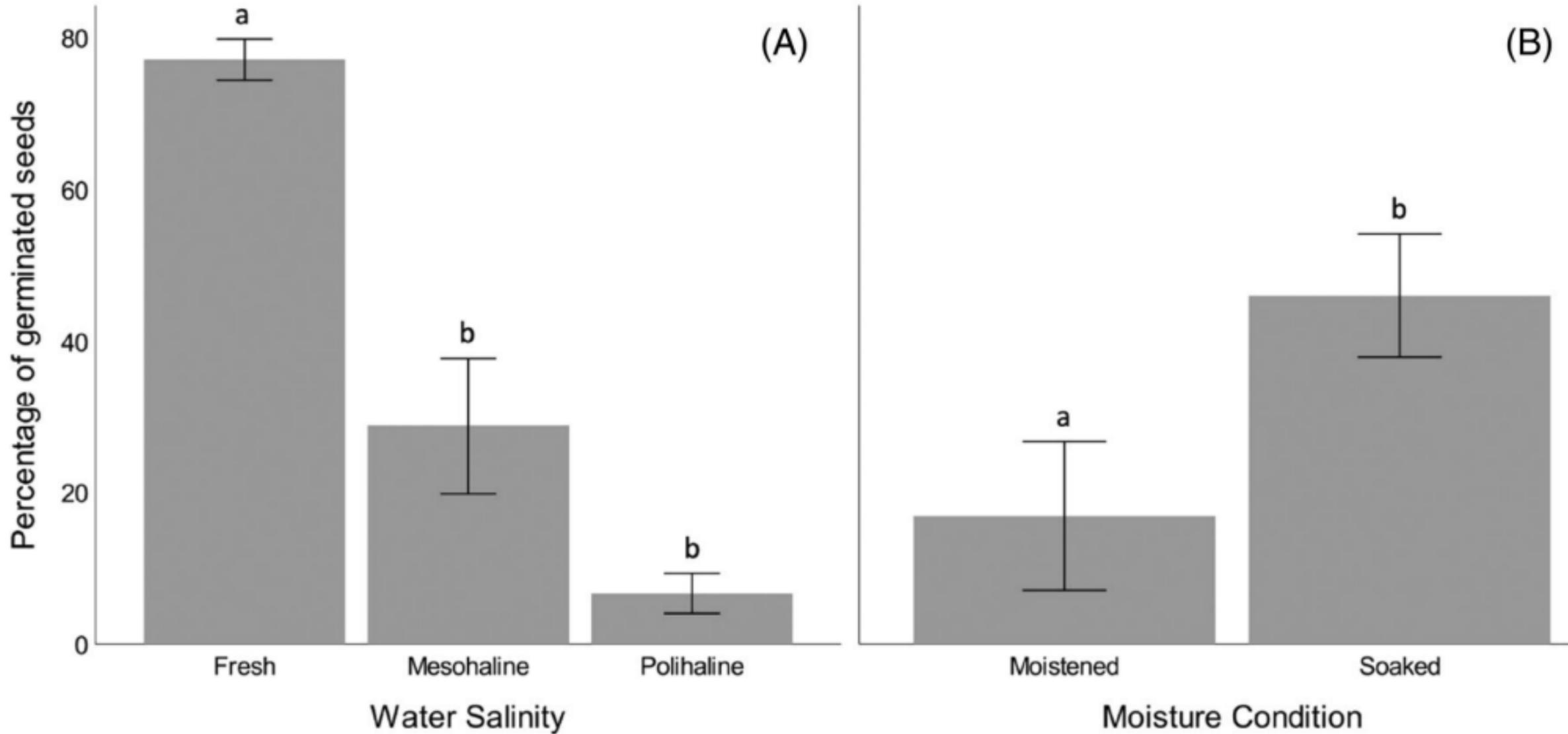


Figure 4. Germination percentage (mean \pm SE) of *Cortaderia selloana* seeds in different (A) water salinities and (B) moisture, under laboratory conditions. Different letters above bars indicate significant differences (Dunn's test: $p < 0.05$) within each treatment considered. $n = 720$ seeds.

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Resultados - germinação das sementes em campo

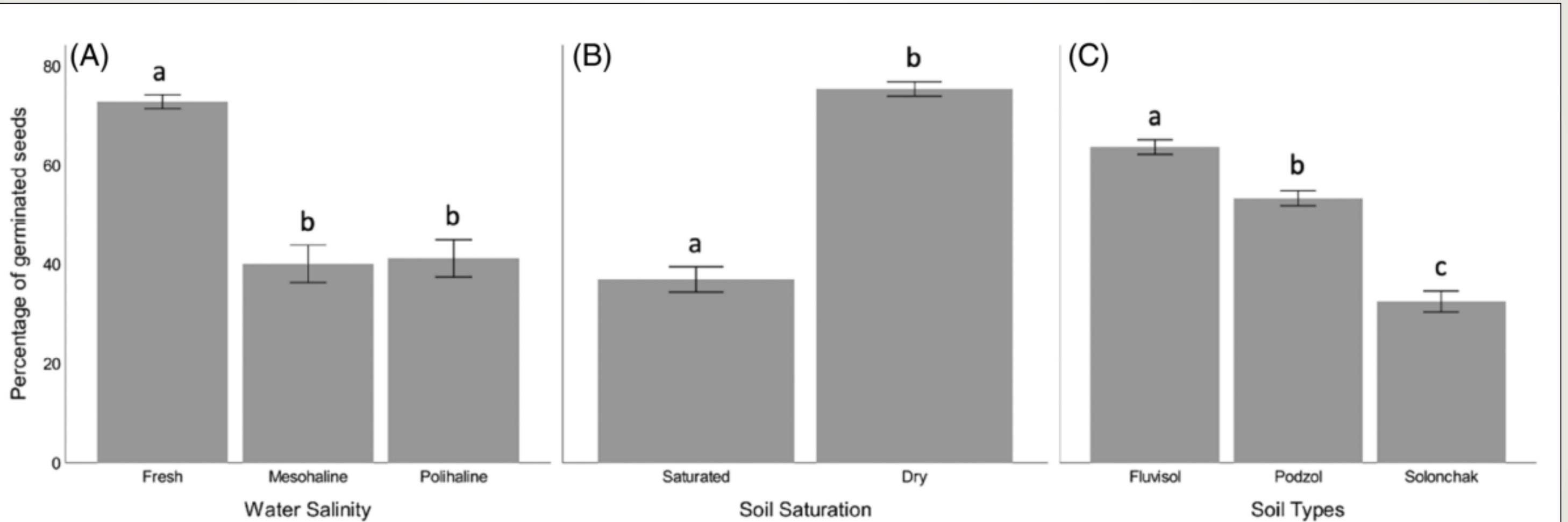


Figure 5. Germination percentage (mean \pm SE) of *Cortaderia selloana* seeds in different (A) water salinities, (B) soil saturations, and (C) soil types, under field conditions. Different letters above bars indicate significant differences (Dunn's test: $p < 0.05$) within each group considered. $n = 4739$ seeds.



Resultados - longevidade do banco sementes em campo

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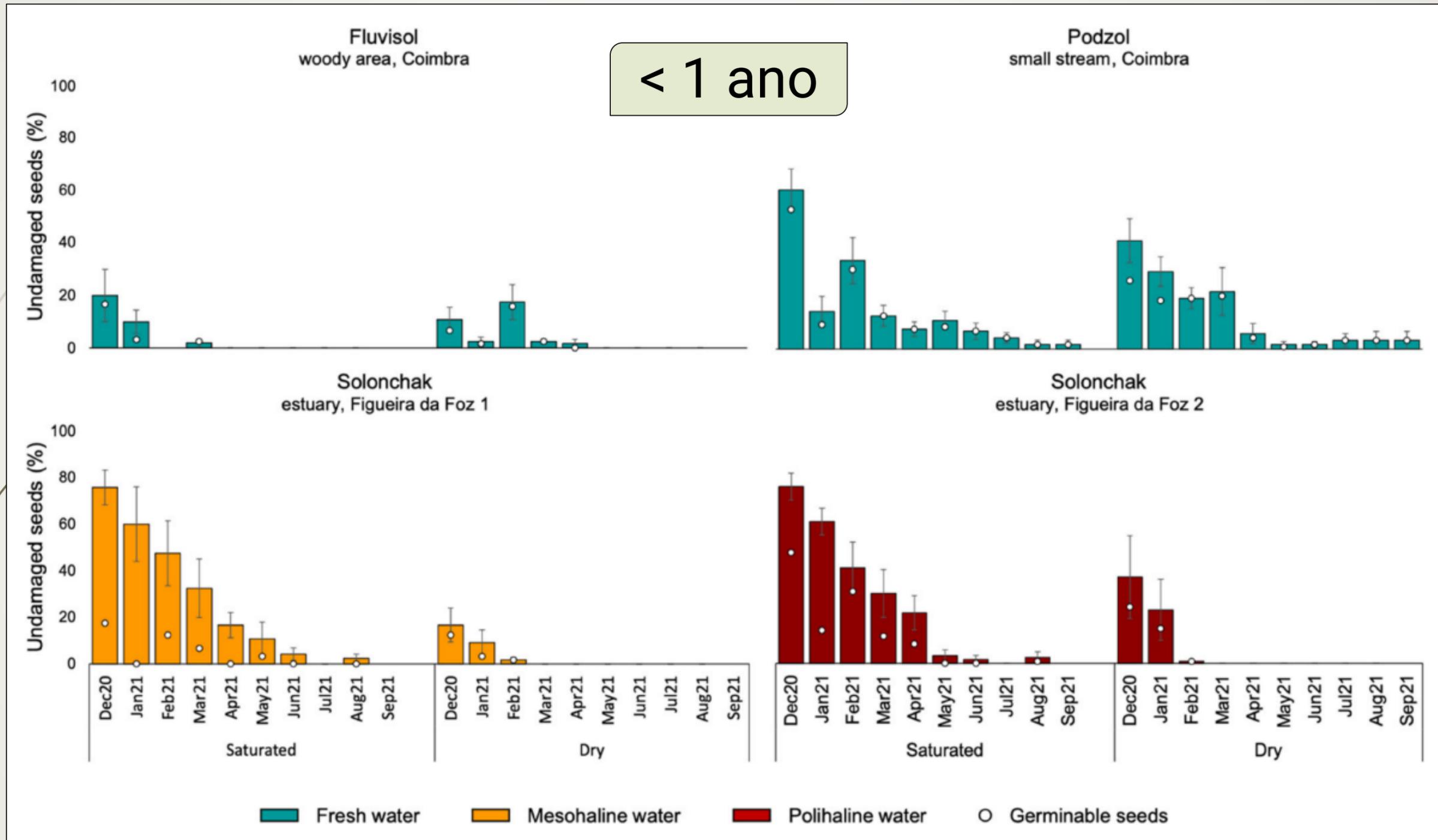
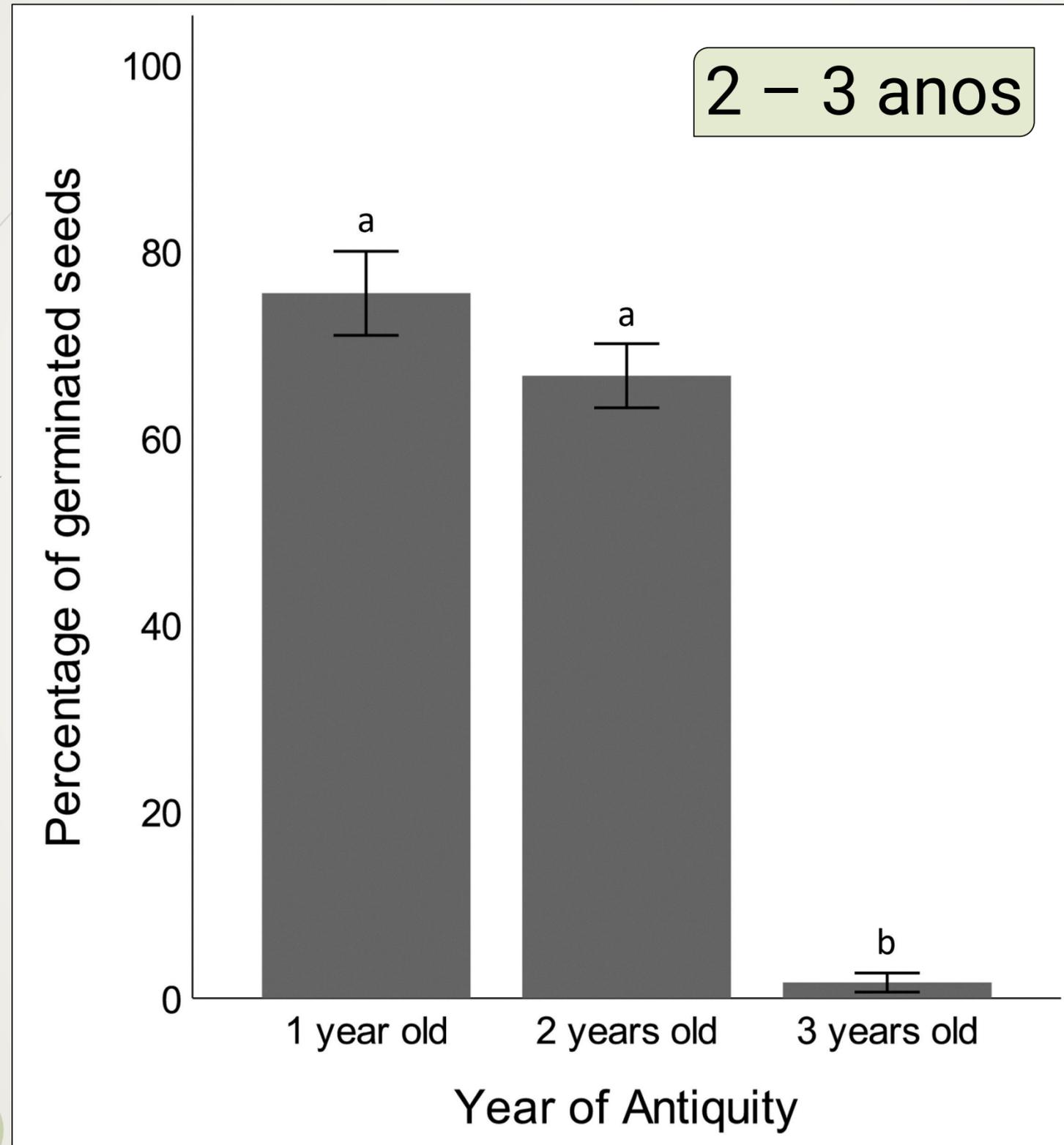


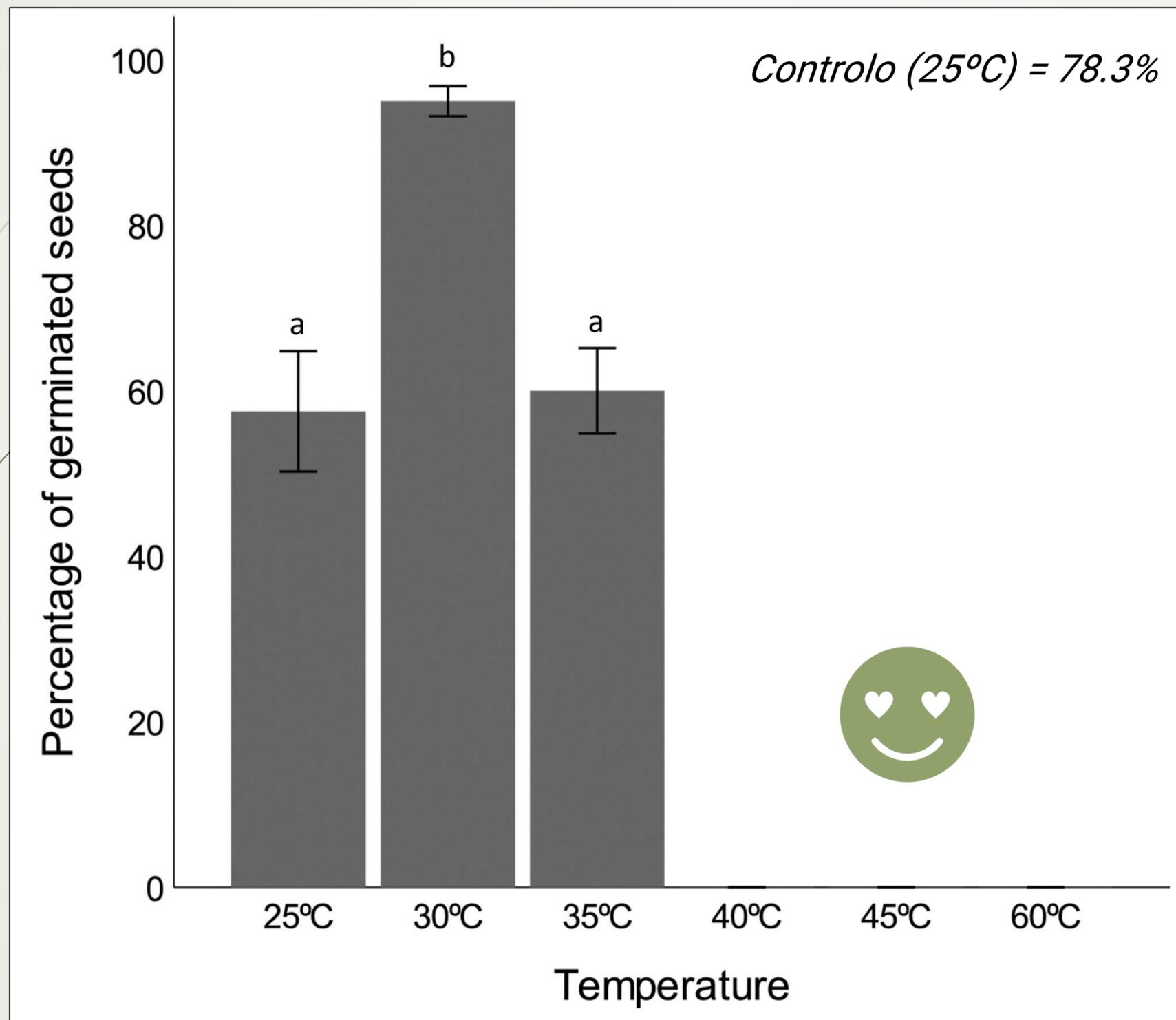
Figure 6. Percentage (mean \pm SE) of *Cortaderia selloana* undamaged seeds that were recovered (bars) and germinated (white dots inside the bars) in different field conditions (water salinity: fresh, mesohaline, polihaline; soil saturation: saturated and dry; soil type: fluvisols, podzols, and solonchak) from December 2020 to September 2021, as a proxy for seed bank longevity. In September 2021 only the small stream site (podzol) was monitored, with half of the seeds from August, since there were still viable seeds in the last months in both levels of soil saturation. $n = 1102$ seeds.

Resultados - longevidade do banco sementes em lab.

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Resultados - germinação às escuras



Compostagem:
> 65°C às
escuras

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Destruição das
sementes viáveis

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- Plantas femininas morfológicamente semelhantes às hermafroditas.
- Hermafroditas têm baixa produção de sementes, e estas são menos viáveis.
- Sementes aparecem após três semanas da floração, e germinam em diversos ambientes.
- Banco de sementes dura menos de um ano em campo, dois a três anos em armazenamento ideal.
- Sementes são destruídas acima de 40°C no escuro.
- *Spanolepis selloanae* presente em Portugal continental apenas em plantas femininas.



Implicações para a gestão

- Em ações de controlo, distingue-se o sexo das plantas pelas flores.
- Remover plantas femininas previne sementes; hermafroditas, pólen e alergias.
- Controlar plantas antes da libertação das sementes.
- Descartar plantas com sementes em compostos acima de 40°C.
- Monitorizar áreas controladas por 2-3 anos; mais tempo se houver outras plantas próximas.
- Colaboração entre cientistas e gestores melhora o controlo de plantas invasoras.
- Investir em educação/divulgação sobre espécies invasoras é essencial.

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Obrigada!

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