The influence of light and culture media on the growth of the red seaweed *Gracilaria gracilis* (Rhodophyta, Gracilariales) under laboratory conditions

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1 Introduction

Seaweed culture systems worldwide aim to achieve high biomass production and profitable yields, by adopting methodologies specifically designed for a target species. In this sense, research aimed at improving the growth conditions of the red seaweed *Gracilaria gracilis*, a gracilarioid widely cultivated worldwide, is of utmost importance, mainly due to the importance of this genus as an agarophyte, but also as a food and feed component (Abreu et al. 2015). Therefore, the present work aims to assess the influence of light and culture media on the vegetative growth of the red seaweed *G. gracilis*, performed at a small-scale and under laboratory conditions.

Figure 1: Map and sampling site of *Gracilaria gracilis* populations from Figueira da Foz (FF) and Lagoa de Óbidos (LO).

2 Methods

Sampling, cleaning, and individual sorting → Acclimatization (7 days) → Assays:

- Light souce and intensity
- Container type
- Nutritional media

Culture Conditions Setup:

- Temperature: 20-24 ºC
- Salinity: 32-35 ‰
- Photoperiod: 16:8 L:D
- Aeration: constant, filtered (0.2 µm)

Light Source/Intensity:

- Grolux + Daylight 3000 lux (GL+DL 3000)
- Grolux + Daylight 3000 lux (GL+DL 1500)
- White Cool Light 1500 lux (WCL 1500)

Nutritional Media:

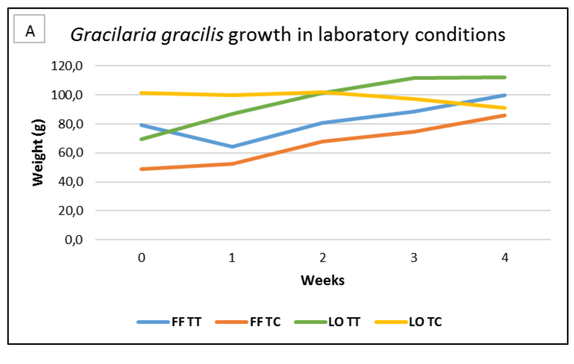
- Von Stosch Enriched modified (control)
- F/2
- Complesal Fertilizer 12:4:6

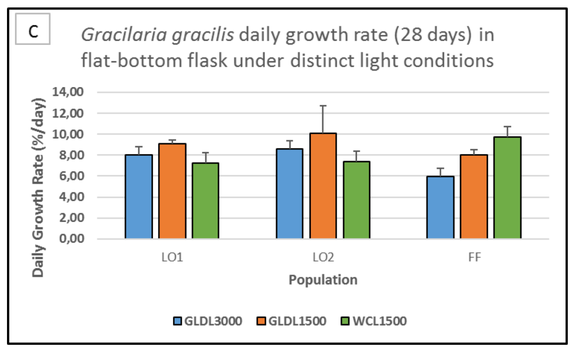
Daily Growth Rate (% day^{-1})

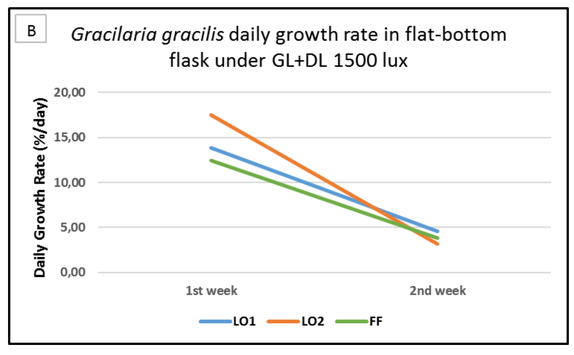
$$= \left[\left(\frac{L_t}{L_0} \right)^{\frac{1}{t}} - 1 \right] \times 100$$

Figure 2: Containers tested, and formula applied to evaluate Daily Growth Rate (Hayashi et al. 2011).

3 Results







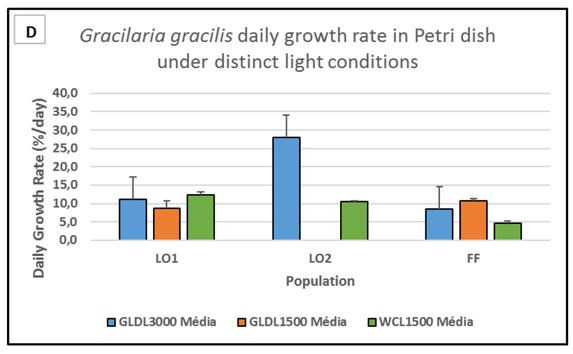


Figure 3: *Gracilaria gracilis* growth results under laboratory conditions: (A) Growth in distinct containers, (B) Growth rate under growlux and daylight combo (1500 lux), (C) growth rate in flat-bottom flask, and (D) Petri dish. Results are expressed as means and the vertical line above each bar represents the standard deviation for all charts. *n* = 3.

Figure 4: Tips growing in the highest light intensity did not perform so well, confirmed by the discoloration visually observed in most tips. This particular result stands in agreement not only with the knowledge that prolonged exposure to strong light intensities is harmful to *Gracilaria* spp., especially regarding young individuals (Raikar et al. 2001), but also in agreement to the natural light-sheltered conditions where this species has been usually found thriving.

4 Conclusion

G. gracilis presented a distinct behaviour according to (1) the type of container, (2) the chosen nutritional media, and (3) the distinct light sources and intensities studied, growing well in seawater supplied with VSE medium, whereas individuals placed in F/2 or Complesal medium died within the first and second week of assays, respectively.

Daily growth rate values showed a decreasing progression after the first two weeks in culture, regardless of the light source, leading to the hypothesis that the nutrient supply routines adopted were the limiting factor for the *G. gracilis* growth after the first two weeks of culture. Nutrient demands that come with increasing growth rates must be therefore considered, to ultimately manipulate *G. gracilis* biomass growth while keeping an economically feasible culture system.

5 References

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