GROWTH RATES AND SKELETAL DENSITY OF *DESMOPHYLLUM DIANTHUS* - EFFECT OF ASSOCIATION WITH ENDOLITHIC ALGAE

VII-8

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Purpose

The cold-water coral *Desmphyllum dianthus* is host to two species of endolithic algae: the chlorophyte *Ostreobium queckettii* and the cyanobacterium *Plectonema terebrans* (fig. 1). In this association the endoliths occur exclusively in areas of the skeleton that are covered by coral tissue which has led to the hypothesis that the relationship may be mutually beneficial (Försterra & Häussermann 2008). Such a relationship would be unprecedented since so far no examples of a coral-algal symbiosis have been documented in cold-water systems. To determine the character of the association between *D. dianthus* and its endolithic algae growth performance and skeletal density were examined under the assumption that a symbiosis would positively affect coral calcification.

Fig. 1: *D. dianthus* at Fjord Comau infested by *O. queckettii* (left) and *P. terebrans* (right); modified after Försterra & Häussermann (2008).

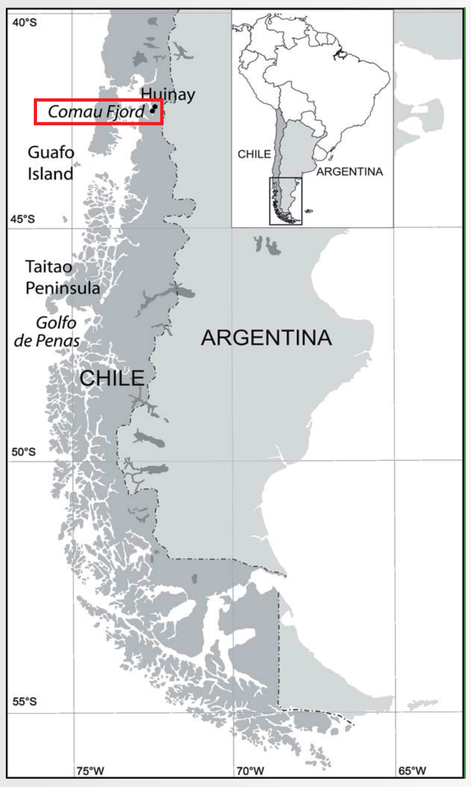

Fig. 2: Map of the fjord region in southern Chile, *D. dianthus* sampled at Fjord Comau (red square); modified after Försterra et al. (2005).

Methods

- Sampling site: Fjord Comau, southern Chile (fig. 2)
- *D. dianthus* stained four times with calcein between January 2006 and 2007
- Coral skeletons sectioned longitudinally (fig. 3) to measure linear apical extension of septa between individual tips of fluorescent growth bands (fig. 4)
- Growth rates tested for an effect of endolithic infestation and seasonality
- Skeletal density determined via x-ray computed tomography (CT)
- Mean density of the apical part of the coral skeleton that had been covered by tissue compared between infested and non-infested individuals

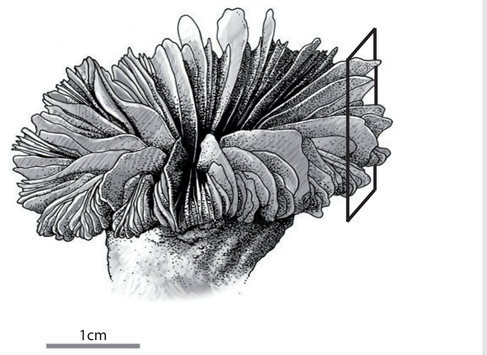

Fig. 3: Schematic of *D. dianthus* depicting the plane of the longitudinal sections to measure the linear extension of septa; modified after Roberts et al. (2009).

Fig. 4: Longitudinal section of a septum of *D. dianthus* displaying four distinct growth bands.

Results

Growth rates:

- Median rowth rates of non-infested individuals approx. twice as high as those of infested specimens (t-test on log-transformed data, $p<0.05$; fig. 5 left)
- Additional to the effect of endolithic infestation: pronounced seasonal pattern of septal growth rates (RM-MANOVA on log-transformed data, $p<0.001$)
- Contrary to what was expected minimum growth rates coinciding with peak temperatures in summer (Jan ´06 - Apr ´06)

Skeletal density:

- Mean skeletal density of infested individuals approx. 6% lower than that of non-infested polyps (t-test, $p=0.146$; fig. 6 left)
- Algal infestation affecting skeletal morphology: infested individuals displaying thicker septa, in some cases tumor-like protrusions of septa (fig. 6 right)

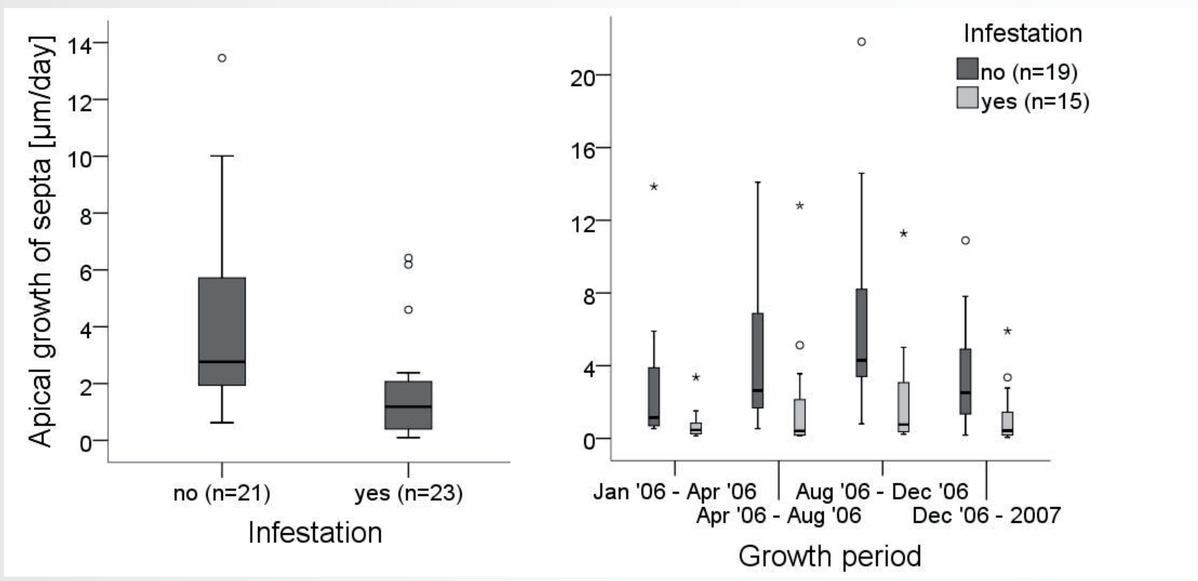

Fig. 5: Apical septal growth of non-infested and infested *D. dianthus* at Fjord Comau averaged over the whole sampling period (Jan ´06 - 2007; left) and among seasons (right), boxplot depicting median, interquartile range and non-outlier minimum and maximum, empty circles: mild outliers, asterisks: extreme outliers.

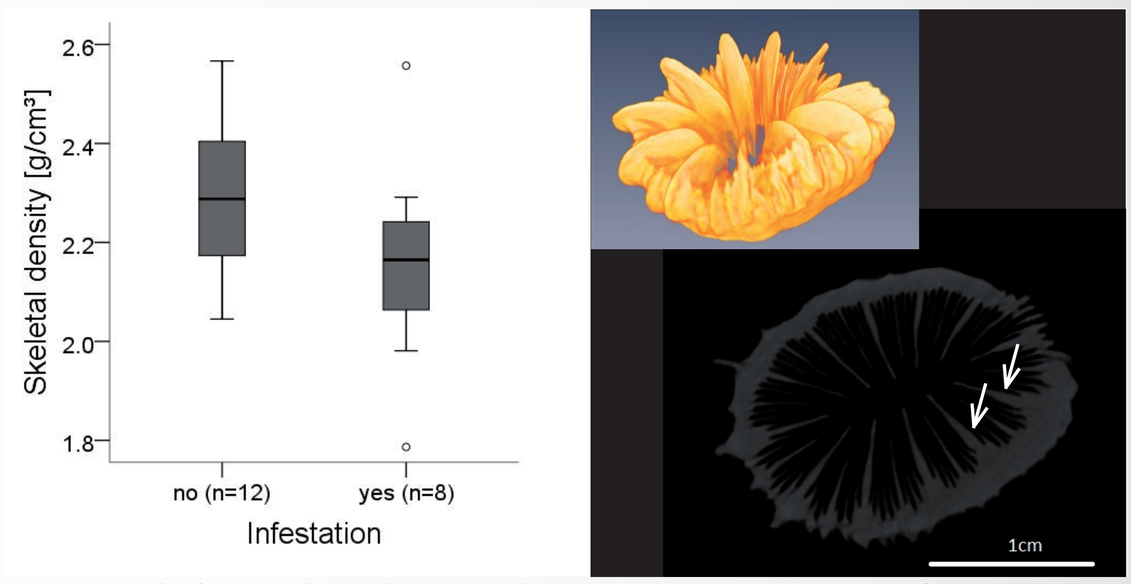

Fig. 6 right: Skeletal density of non-infested and infested *D. dianthus* at Fjord Comau, boxplot set-up similar to fig. 5; left: CT-scan of *D. dianthus*, upper right hand corner: three-dimensional rendering of apical part of the same infested specimen, thicker skeletal structures compared to non-infested polyps indicated by arrows.

Conclusion

Unlike hypothesized the association between *D. dianthus* and its endolithic algae has the character of a parasitic relationship. Algal infestation seems to result in significantly reduced growth rates and possibly decreases skeletal density. It may further cause skeletal deformations as a response to the presence of parasites. The seasonal pattern of apical growth rates of *D. dianthus* is preserved in infested individuals and may consitute a trade-off between growth and reproduction which is suspected to take place in summer. Although this study appears to conclusively indicate a negative effect of endolithic infestation, controversial results have been obtained by ongoing experiments on the transfer of metabolites between the endoliths and the coral host (Försterra et al. 2012). Further research will be necessary to confirm the status of the relationship between *D. dianthus* and its endolithic algae.

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