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Biogeosciences Discussions

Interactive comment on "Physiological constraints on the global distribution of *Trichodesmium* – effect of temperature on diazotrophy" *by* E. Breitbarth et al.

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Review and Comments for the manuscript of Breitbarth, Oschlies, LaRoche: Physiological constrains on the global distribution of Trichodesmium-effect of temperature on diazotrophy

The authors systematically test the effect of temperature on a variety of physiological parameters of axenic Trichodesmium cultures to characterize the optimal temperature range for the survival. These parameters include: 1) chlorophyll-a, carbon, and nitrogen specific growth rates, 2.) carbon specific N2-fixation rates, (in μmol l-1 h-1) 3.) chl.-a: POC and POC:PON molar ratios and 4.) photosynthetic quantum use efficiency

from acclimated and non-acclimated cultures of Trichodesmium spp.. The information is supposed to improve model estimates of global N2 fixation rates since the climate change scenarios predict higher SST over the next decades. The overall scientific question of this investigation is well addressed by the experiments and the results highly relevant not only for modellers. I found it especially interesting to read the discussion on whether an overall increase or decrease in nitrogen fixation results from a SST increase or not. As often in nature it seems difficult to predict and one effect may outweigh another. However, it would be good to provide a short explanation on the motivation to determine three different specific growth rates. Based on these results the authors define the tolerable temperature range of 20 to 34 °C and the optimum temperature range between 24 to 30 °C with a maximum at 27°C for Trichodesmium growth and N2-fixation. N2 fixation was measured with the ARA and assesses the activity of all nitrogenase activity instead of the incorporated nitrogen into cell estimated by means of 15N2 (see Capone & Montoya, 2001, in Methods in Microbiology Vol. 30, Academic Press pp 501-514) - this may be considered in the discussion. The interaction of photosynthesis and N2-fixation is well discussed within the physiological context. The discussion relative to light is very interesting, but the one on nutrients remains somewhat unsatisfactory. The motivation of the authors to touch on the subject of genetics is not clear. The second part of the discussion contains many repetitions (e.g. p. 790, l. 11 - 13 and l. 26 - 27 or p. 790, l. 15 and p. 791, l. 5 - 10) which makes it difficult to find the “take home message”. Some restructuring and shortening would help.

minor comments are: (pages refer to numbers below the text) p. 782, line 5-7: What direct and indirect effects of temperature are meant. p. 788, line 17-18. How do light and nutrients interact with temperature and what is meant with determinant roles. p. 789, line 11: What role does Rubisco activase play? How about other enzymes, e.g. nitrogenase? p. 789, line 18 - 29 does not refer to actual results and may be left out. The same is true for page 792, line 11-23. The latter may better fit at the end of page 789, where a more general discussion of diazotrophs starts. p. 792, line 3:

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Why restrict? Fig. 1: maybe shade the area of tolerable and optimal temperature in grey? Maybe draw in lines for the other curves as well. N2-fixation rates should be in mmolL-1h-1 rather than in mmol N2 mol POC-1 h-1. It is not clear how many samples were analysed per point in the figure. Are the error bars standard errors? Are the individual measurement series parallels or different approaches, e.g. adapted vs non adapted cultures as in Fig. 4? Fig. 2 is too small, maybe better as table? Why does it say “no-growth - slow reduction in biomass” on the one plot? It is not possible to say “versus temperature” if no temperature is shown on either axis, better say e.g. “under different temperatures”. Fig. 3: better keep consistency in spelling of the axis labels (temperature in Fig. 1, Temperature in Fig. 3 and 4). It is not clear where the standard errors given come from, e.g. Fig. 2 shows only one regression coefficient for each respective temperature. “weight:weight” should be “μgL-1:μgL-1”. Give the function, n, and R2 for the linear regression. Fig. 4: Include the temperature tolerance range (20-34 °C) and the Fv/Fmmin and Fv/Fmmax range in both plots. What is the basis for the line connecting the measurements at the different temperature points?

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