**Title: Carbon and nitrogen incorporations by the farmed seaweed, *Kappaphycus alvarezii* and its epiphytes (EFA)**

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Abstract

Faced with the decrease in the fishery resources that they catch, coastal villagers communities in Madagascar are turning to the red algae cultivation, with the species, *Kappaphycus* *alvarezii* to diversify and improve their sources of income. However, the production is disrupted by the appearance of the EFAD or Epiphytic Filamentous Algae Disease, which can reduce the algal production up to 90 %. The EFAD is induced by the epiphytic red algae *Polysiphonia* sp. which kill the infested host at the end of the disease. The mechanism by which host weakness arises is presently not well understood and it is not clear if *Polysiphonia* sp., at initial stage of the infestation, competes with its host to acquire inorganic carbon and nitrogen.

The present work aims to assess the effects of *Polysiphonia* sp. on its host in term of nutrients uptakes *in situ* at initial infestation stage. Using 15N and 13C labeled substances, we have measured experimentally *in situ* the incorporation of nitrogen (NH4+) and inorganic carbon in infested algae in *K. alvarezii* at two different sites, Tampolove (S 22°13'29.7''; E 43°15'37.3'') and Lambohara (S 22°10'46.2"; E 43°15'3.1"), both located in Baie des Assassins, (Southwestern region of Madagascar). Solutions of sodium bicarbonate (13C, 99 %, Eurisotop, France) and ammonium chloride (15N, 99 %, Eurisotop, France) were injected in transparent plastic bags containing thallus of healthy (n = 5 per experience) and infested *K. alvarezii* by *Polysiphonia* sp. (n = 5 per experience). After one hour, sample were collected and dried (60°C, 48h). Host and epiphytes were separated, weighted precisely (i.e. 0.01 mg) and their 13C and 15N contents were measured using EA-IRMS (Elemental Analyzer – Isotope Ratio Mass Spectrometer).

The quantity of 13C and 15N uptaken by *K. alvarezii* were far greater than those by EFA. *K. alvarezii* (i.e. 2.03 vs. 0.190 μg mgDW of 13C and 10.22 vs. 0.018 mgDW of 15N for host and epiphytes, respectively). This is due to larger biomass of cultivated algae at this early stage of infestation. In term of biomass turnover, 13C and 15N uptake by both organisms differed significantly (0.009 vs. 0.0003 % per hour for C and 0.07 vs. 0.15 % per hour). This indicates that *Polysiphonia* sp. relatively to its biomass incorporate nitrogen faster than its host. At the start of infestation, this is probably not a problem but quickly it could drive to outcompete host for the acquisition of N and therefore contribute to decrease cultivated algae growth.

Keyword: *K. alvarezii*, epiphytes, nutrients, isotopes, 13C, 15N, uptakes