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Plant Science 2018: Light effects on the calcification and morphology of Padina spp.- Miriam Benita, David Iluz and Dubinsky Zvy- Bar Ilan University

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Padina pavonica is one of the common macro-algae that inhabit coastal inter-tidal zones around the world. It is one of the two brown algae known to science today that calcifies. Padina spp. is an extracellular calcifying macroalgae with microscopic morphology of aragonite (CaCO3) needle-shaped, seeing mainly on the ventral side of the thallus as a white stripes. There are some theories about the benefits of the aragonite needles, such as protection against grazers, mechanical support in turbulent water, high radiation protection during low tides, and more. In order to understand the benefits and the evolutionary adaptation of the aragonite needles, we conducted several light gradient experiments on Padina spp. Samples *Padina pavonica* were collected at Tel Baruch Beach, Israel. The results show that under high light the algae possessed more CaCO3 (% Wt) and with it, the color of the reproduction cells on the dorsal side of the thallus, right behind the aragonite strips, become brighter and transparent. The reproduction cells also released earlier to the water column, and their essentiality seems to be damaged. We also found that during full moon light, the aragonite stripes are 40% wider than under new moon. To conclude, this alga is well adapted to light under low tide and to the Israeli sun radiation which shines most of the year. Furthermore, the calcification of the needle-shaped aragonite in the thallus of Padina spp. could possibly be an adaptation to the high light energy allowing the algae to settle and dominate the coastal regions.

Padina is quite unique because it is one of the two calcified brown algae known today (the second one being *Newhousia imbricata*) [1]. CaCO3 is precipitated in the form of needle-shaped aragonite crystals. The aragonite is extra-cellular, mainly on the ventral surface of the thallus, and changes from needle shape into lumpy surface in the older part of the thallus, probably due to mechanical erosion [2]. P. *pavonica* has been well studied since the beginning of the last century and is, environmentally and medically, an important alga, extensively used as a feedstock for the production of biodiesel [3], in heavy-metal biosorption, as a pollution bioindicator, a trace metal biomonitor, an antioxidant, an anticancer drug (by inducing apoptosis of cancer cells, an antibacterial agent, and a bioinsecticide. Morphology The Padina sp. body contains two parts: the thallus, which is divided into 8, and sometimes more, whitish to brownish color fronds, and the holdfast, consisting of flexible rhizoids for surface attachment [4]. The fronds are fan or ear shaped, and can reach up to 15 cm length in summertime, becoming narrower towards the base, reaching up to 2 mm width and about 1 cm length [4]. In winter, they are very small or do not grow at all [4]. Over the years, there have been several suggestions regarding the benefits of Padina sp. calcification. Okazaki et al. [5] suggest that it gives the algae mechanical support in their high-energy environment, that calcification offers protection against grazers. Padilla [6] suggests that it is not protection directly against grazers, but against the tissue damage inflicted by the grazers. Burger and Schagerl [7] suggest that calcification provides protection from excess irradiance [8]. It is possible that all these suggestions are correct and that there is a synergy among the CaCO3 benefits, contributing to the success of Padina in her rough habitat. Over the years, there have been several suggestions regarding the benefits of Pa-dina sp. calcification. Okazaki et al. [24] suggest that it gives the algae mechanical support in their high-energy environment, whereas Gil-Díaz et al. [9] think that calcification offers protection against grazers. Padilla [8] suggests that it is not protection directly against grazers, but against the tissue damage inflicted by the grazers. Burger and Schagerl [3] suggest that calcification provides protection from excess irradiance [8]. It is possible that all these suggestions are correct and that there is a synergy among the

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