TITLE: HIGH-AFFINITY PHOSPHATE UPTAKE SYSTEM SUGGESTS ADAPTIVE ADVANTAGE.

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ABSTRACT

All living organisms, including plants, require phosphorus for its growth. A putative crisis of this vital element is expected in a near future due to its incessant and excessive exploration. Fortunately, unlike oil, it can be recycled. One response to its depletion would be to look for microorganisms efficient in capturing phosphorus from the environment. Bacteria accumulate phosphate as a linear polymer - polyphosphate (PPi), linked by energy-rich phosphoanhydride bonds. Pi molecules are captured via two transport systems: a constitutive system of low affinity, expressed in high concentration of phosphate, and a system of high affinity, expressed in a limited availability of the nutrient. In this work, we investigated a putative adaptive advantage of microorganisms efficient in phosphate accumulation, i.e., those able to express the system of high affinity. All tests were performed using a strain of Pseudomonas aeruginosa expressing the low affinity system, and an isolate of Serratia sp. expressing the high affinity system. The bacteria were pre-cultivated in a phosphate-accumulating condition (TGP broth – salt supplemented with 4 mM phosphate) for 18h, at 30 oC, under 150 rpm agitation. The Pi capture was measured colorimetrically, using a solution containing 167 mM sulfuric acid, 2.5% ammonium molybdate, 10% ascorbic acid. After the period of phosphate accumulation, the strains were cultivated in two growth conditions: re-incubation in TGP, and in Luria-Bertani broth. The cultures were maintained at 30 oC under agitation at 150 rpm and the cell growth measured (= 600 nm) at 3 hours intervals. P. aeruginosa cultivated in TGP captured, approximately, 1 mM, while Serratia sp captured 3 mM out from the broth containing 4 mM phosphate. Under these conditions, Serratia sp. exhibited exponential growth immediately after the re-inoculum in TGP, while in LB showed the standard phases of growth curve. This result is consistent with a metabolic adaptation to the new medium. Although both had shown the same growth pattern, P. aeruginosa´s growth was statistically lower in both systems, suggesting that in specific conditions, bacteria that stock phosphate, take advantage in growth, probably, due to the use of polyphosphate as source of phosphate and also energy. In order to refine this model, several tests are in progress, such as monitoring the growth by UFC and by dry weight, and also by genetic analysis of the high affinity phosphate capture system.

Keywords: Capitation of phosphate, Polyphosphate accumulation, Regulon PHO.

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