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Rim Maougal, Alain Brauman, Claude Plassard, Josiane Abadie, A. Djakoun, Jean-Jacques Drevon

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Phytate mineralising bacteria increase in the rhizosphere of nodulated common bean (*Phaseolus vulgaris*) under P deficiency

Maougal^{1,2} R.T., Brauman³ A., Plassard¹ C., Abadi J¹., Djakoun² A. and Devon¹ J.-J.

maougal@gmail.com

¹ UMR Eco&Sols - Place Viala - 34000 Montpellier - 34 - France

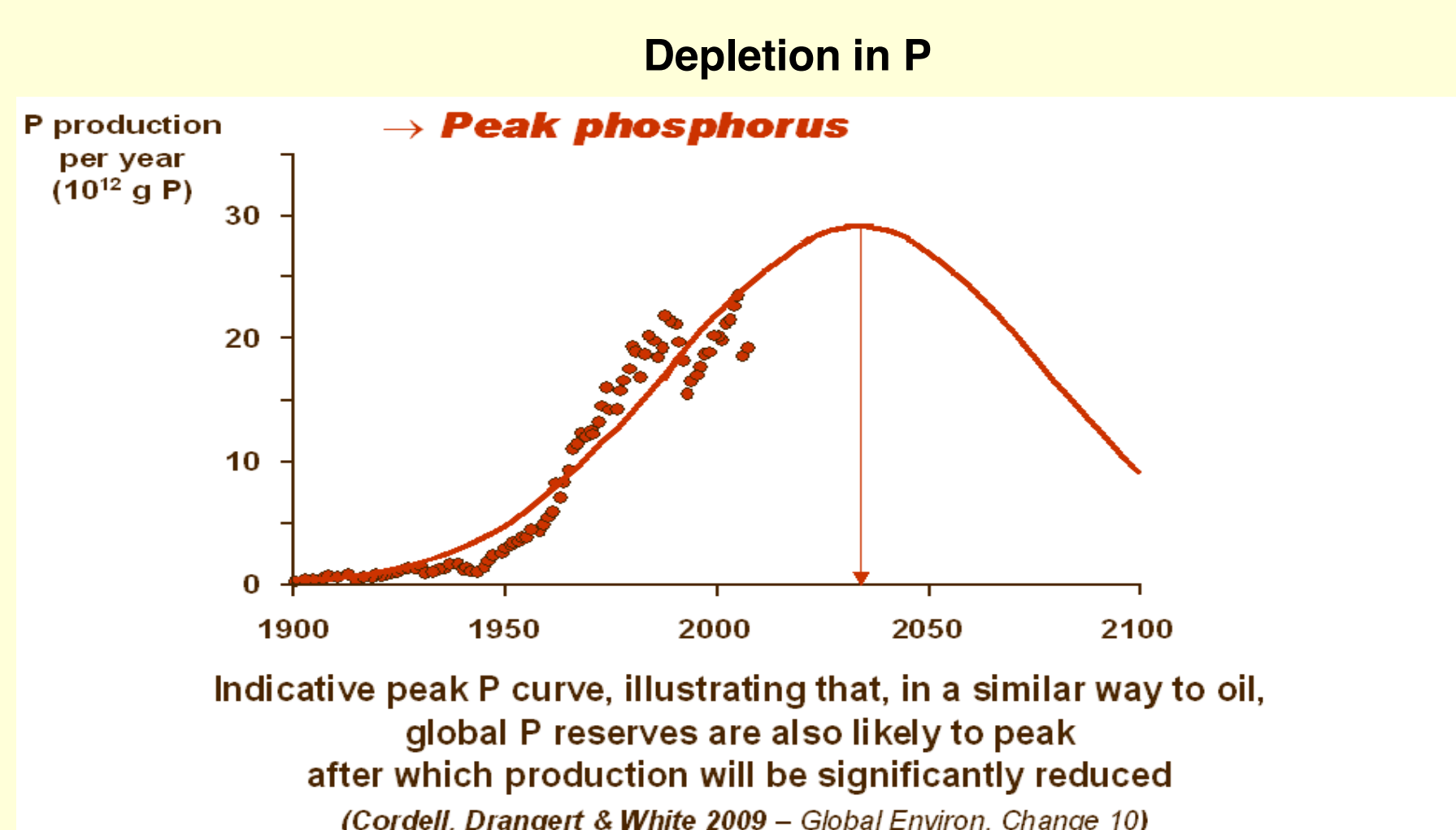
² Laboratoire de Génétique, Biochimie et Biotechnologies Végétales, Département de Biologie et d'Ecologie, Université Constantine 1, Route de Ain el Bey, Constantine, Algeria.

³ IRD, Eco&Sols, Land Department Development, Bangkok, Thailande

I- Context:

A more sustainable agriculture based on the reduction of mineral fertilizers as Inorganic phosphate

P is one of the most limiting nutrients for plant growth in soil.

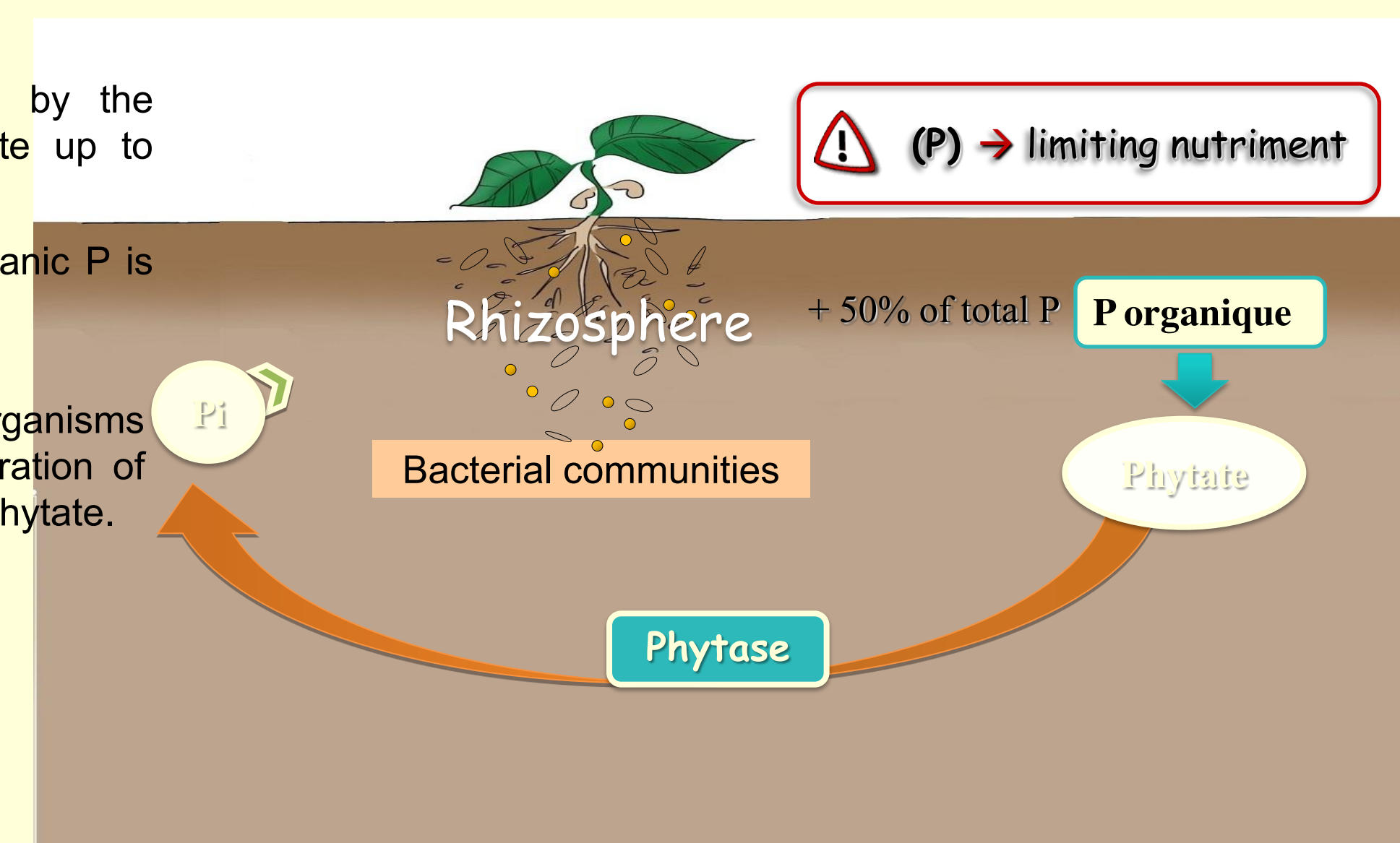


Replace the mineral P by the organic P which constitute up to 80% of total P.

One of the dominant organic P is the phytate

Ability of certain microorganisms to increase the concentration of soluble P by degrading phytate.

An urgent need to reduce P inputs

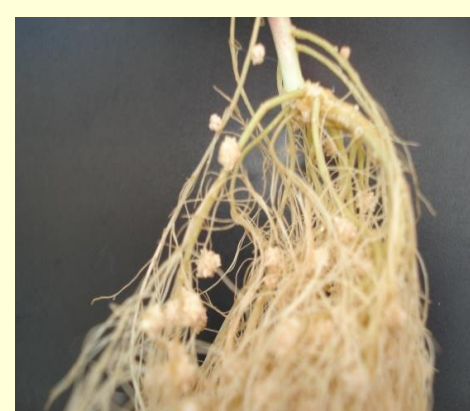


Objective: The aim of this work is to characterize the functional microbial community involved in the mineralization of phytate in the rhizosphere of a leguminous plant (*Phaseolus vulgaris*)

II- Materials and methods:



Phaseolus Vulgaris RIL 147: chosen as model plant.



Have a great P acquisition by its nitrogen fixation



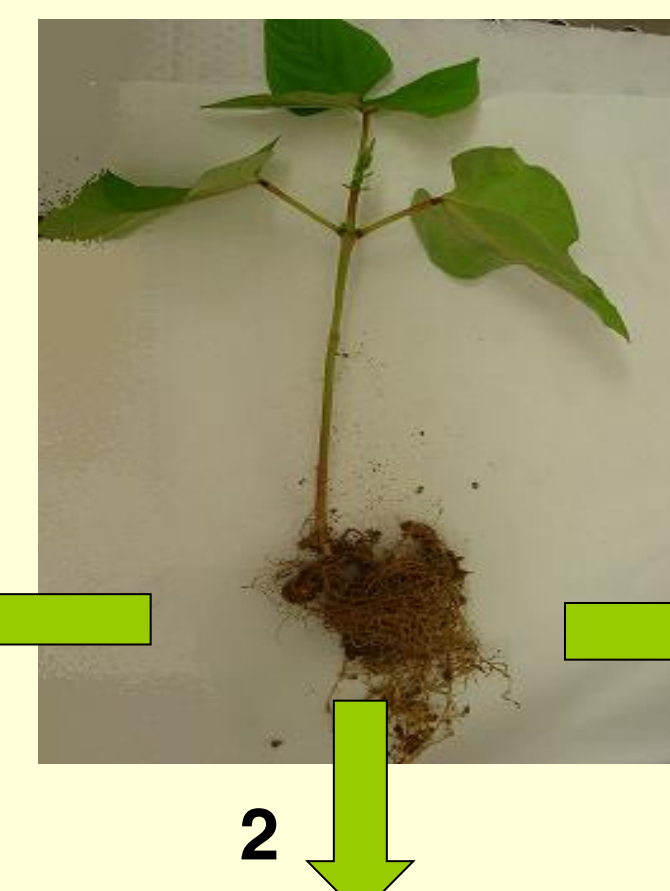
Sterilised seeds were grown in pots under greenhouse.

A comparison between P deficient soil (P-: 15mg/kg) and control soil (P+: 50 mg/kg)

Extraction of rhizospheric bacteria and determination of isolates able to mineralise phytate

Density: bacterial colony counts and isolation.

Culture on a specific medium containing phytate as a sole source of P. Bae and al 1999.



The capacity of the isolates to release Pi from Na-phytate in broth was assayed.

Their phytase activity was measured on bacterial pellet and supernatant after a 72 h incubation period according to Shimizu (1992) with modifications.

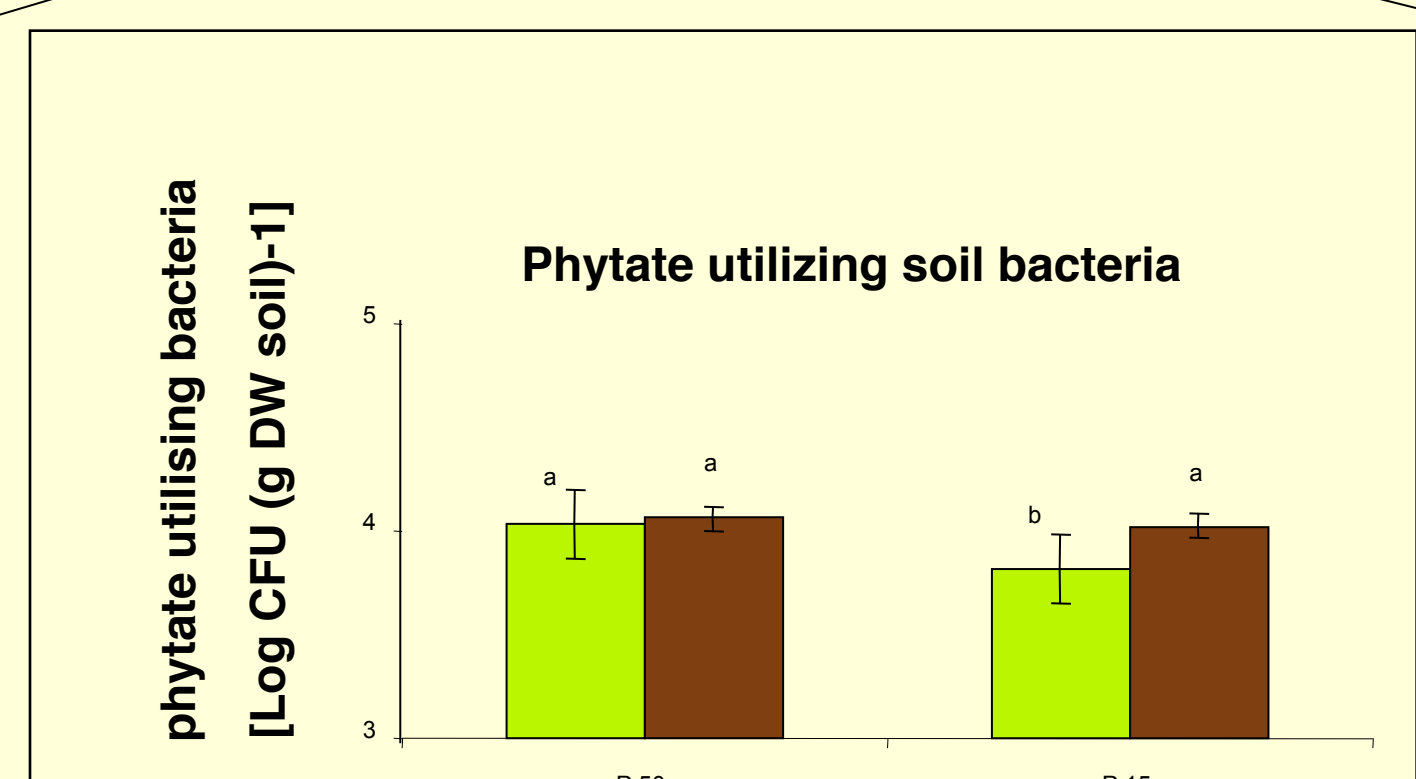
III-Results

1-Density of the culturable bacterial

Growth of isolates on screening phytate medium.



Translucent medium around the bacteria = solubilisation of phytate by acidification.



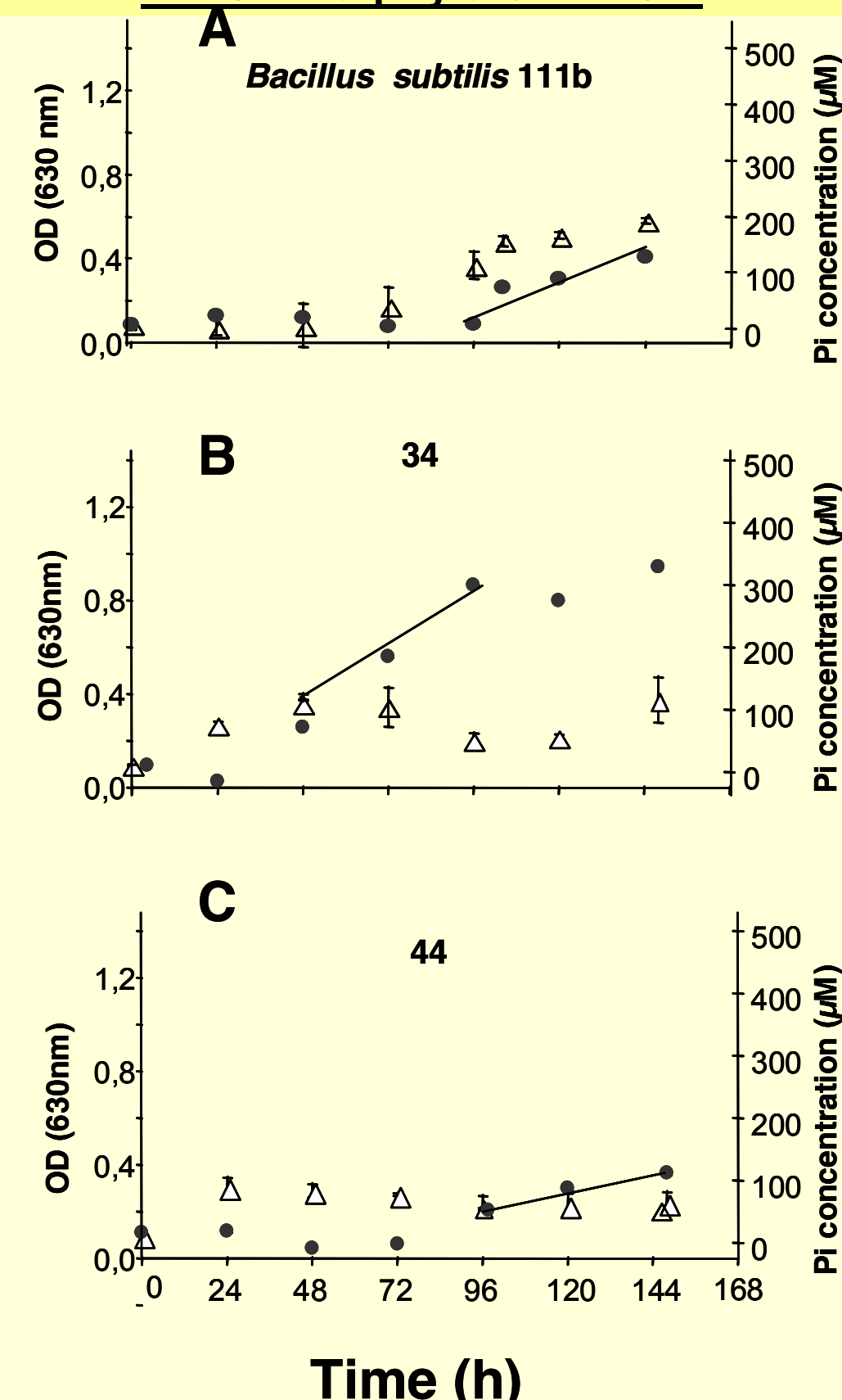
Bacteria able to grow on the modified Angle medium represented 1% of total number of bacteria that were able to grow on the rich medium (LB).

Under P15, the density of phytate-utilizing bacteria on Angle medium was 10 fold higher in rhizospheric soil than in bulk soil, whereas under P50 there was no significant difference

→ selection of phytate-mineralizing bacteria in the rhizosphere of P-deficient bean.

2-The capacity of the isolates to release

Pi from Na-phytate in broth



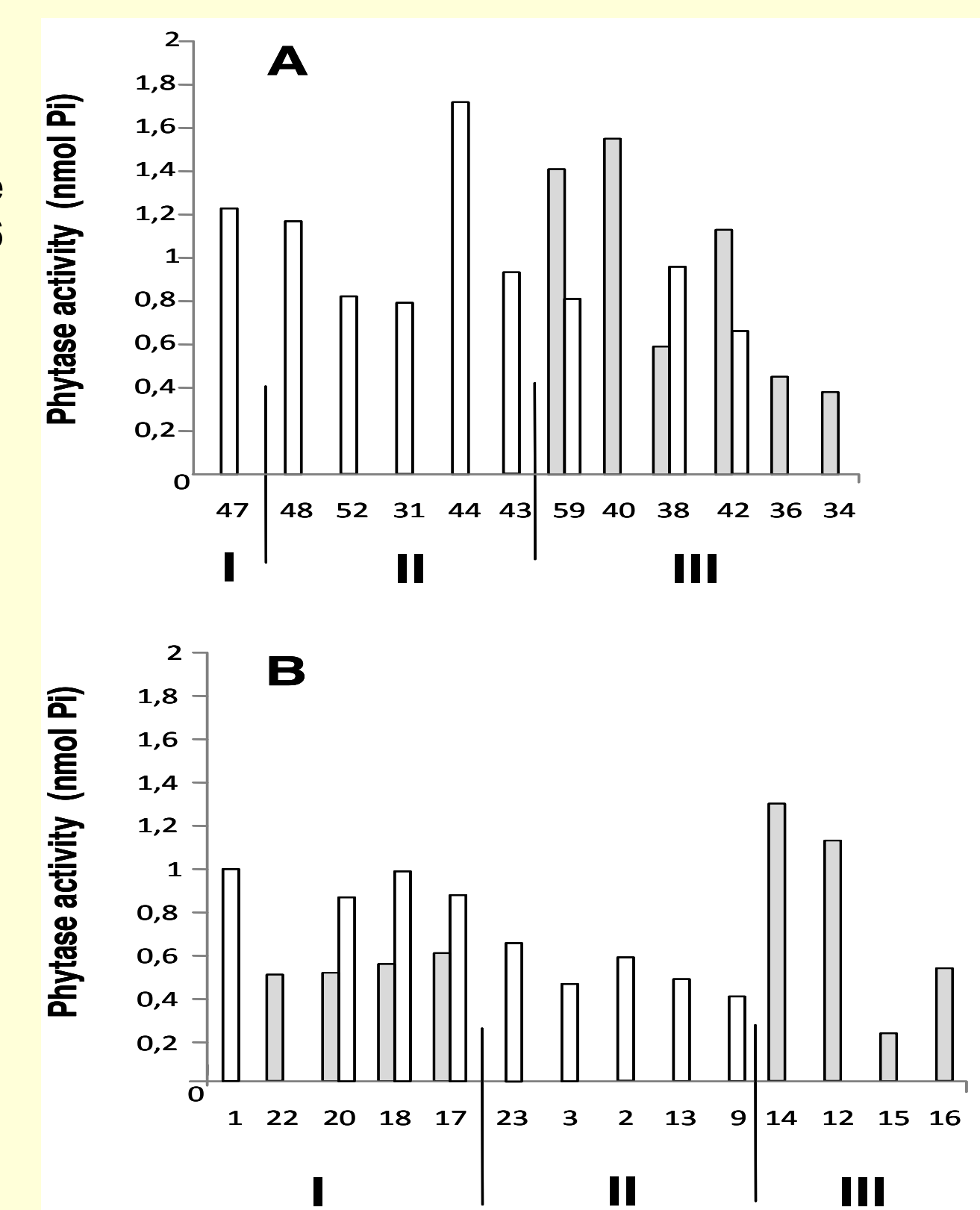
A significant accumulation of Pi in the culture medium was observed for 26 among 34 isolates

The phytase activity varied considerably among isolates of the 3 above groups of curves (figure 2). A majority of isolates produced extracellular phytase. However, some isolates showed additional or exclusive cell-associated phytase.

→ phytate could be mineralized either externally or within the periplasm of the bacteria; these two conditions seem to involve different phytases.

Kinetics of growth (●) and concentration of Pi (△) in the growth medium for rhizobacterial isolates with Na-IHP as sole source of P. for A, *Bacillus subtilis* 111b as representative of group I; B, isolate 34 as representative of group II; C, isolate 44 as representative of group III. Data are means ± sd of 3 replicated cultures.

3-The phytase activity



Extracellular (left) and Cell-associated phytase activity (right) of rhizobacterial isolates. A: on P 50, B: on P15.

Conclusion:

our results indicate that nodulated-bean plants can increase in case of P deficiency, the phytase activities of a diverse community of phytase hydrolysing bacteria within their rhizosphere.

References:

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