

TN01000044/3 – V2

PREZENTACE VÝSLEDKŮ NA KONFERENCI FORMOU ODBORNÉHO SDĚLENÍ– VÝSLEDEK TYPU O (O- OSTATNÍ VÝSLEDKY)

Ústní sdělení na 11. mezinárodní ICCT konferenci, konané 15.-17. dubna 2024 v Mikulově
https://www.icct.cz/cs/Amca-ICCT/media/content/2024/documents/Book_of_abstracts_ICCT2024.pdf

Abstrakt

BACTERIA IN PLANT GROWTH PROMOTION AND PROTECTION

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The replacement of chemical fertilizers and pesticides and the transition to sustainable plant agriculture requires a deeper understanding of interspecies relationships in nature, including those between plants and microorganisms. Many plant-populating bacteria, called epi- and endophytes, can promote plant growth as well as prevent the development of plant diseases or prevent plant pests. The bacteria can thus be used in organic microbial pesticides, fungicides and fertilizers. Useful properties of bacteria in this sense are the production of enzymes such as chitinases, the formation of secondary metabolites inhibiting fungal growth, the ability to produce plant hormones, the solubilization of phosphates, the release of ammonium ions and others. The advantage of using bacteria is also their ability to grow on agricultural and food waste substrates such as brewery mash, whey, waste from animal production (feathers, meat separation residues, fish scales, etc.). These wastes, after relatively easy pretreatment by hydrolysis under mild conditions (no pressure, low acid or base concentration), can be used as a complex culture medium for bacteria. The composition of the culture medium and the setting of culture conditions can influence not only the growth of bacteria but also the production of desired metabolites and enzymes. After cultivation, the whole medium together with the bacteria can be used for application to plants. The concept of this bacterial utilization and at the same time waste valorization within circular economy will be demonstrated with the example of the endophytic bacterium *Pantoea agglomerans* DBM 3797, isolated from hops.

This work was performed thanks to the financial support of the project TACR TN02000044.

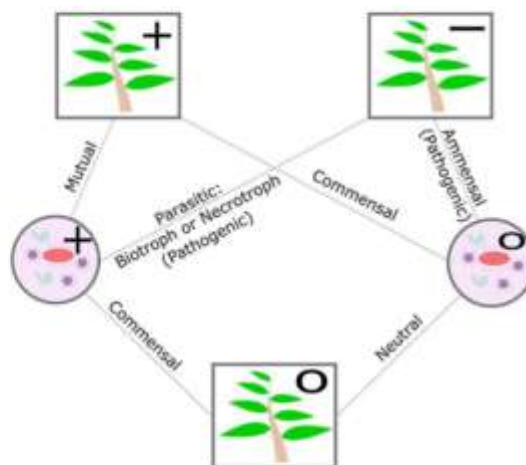
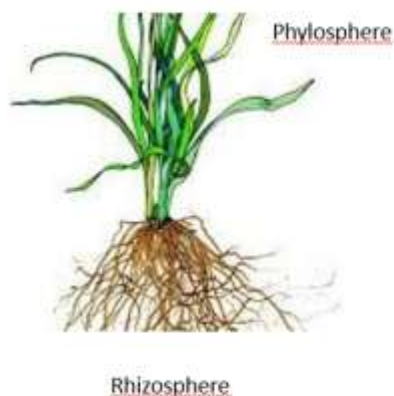
Bacteria in plant growth promotion and protection

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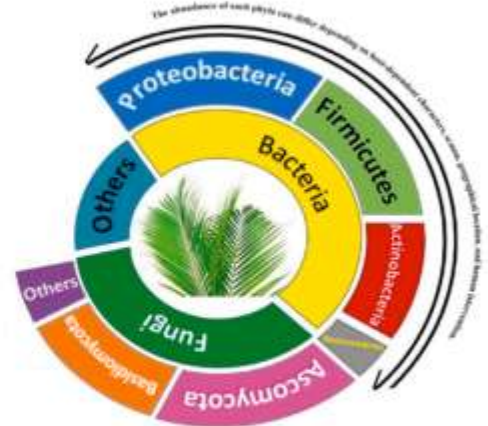
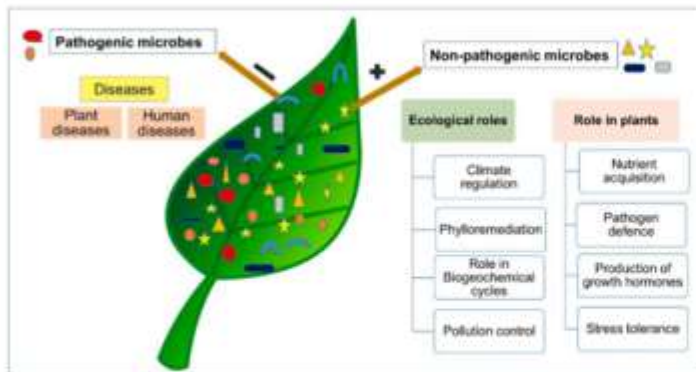
Plants and microorganisms

Plant-microbe relationships



Jones et al., 2016 - <https://www.frontiersin.org/journals/plant-science/articles/10.3389/fpls.2019.00862/full>

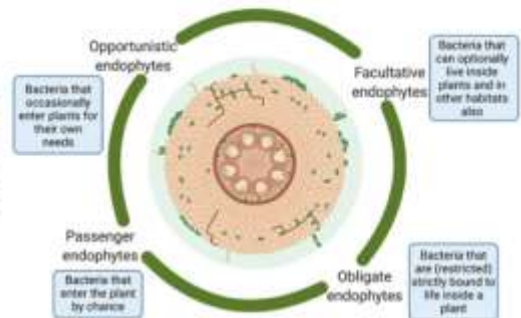
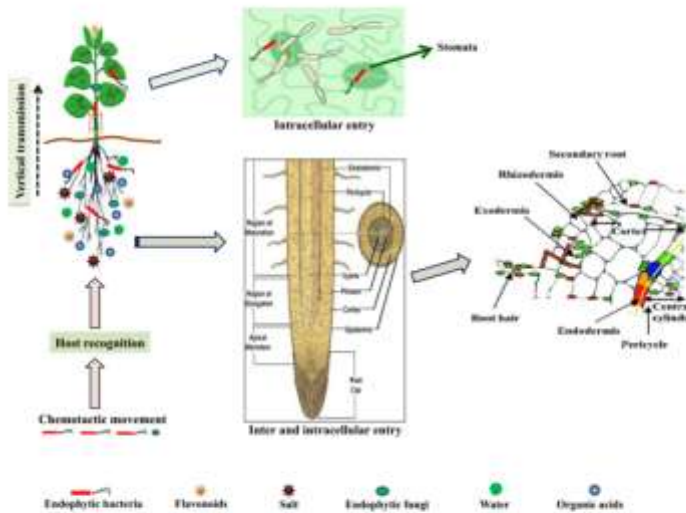
Phylosphere microbiome



Bashir et al., 2022 <https://www.sciencedirect.com/science/article/pii/S0944501321001944>

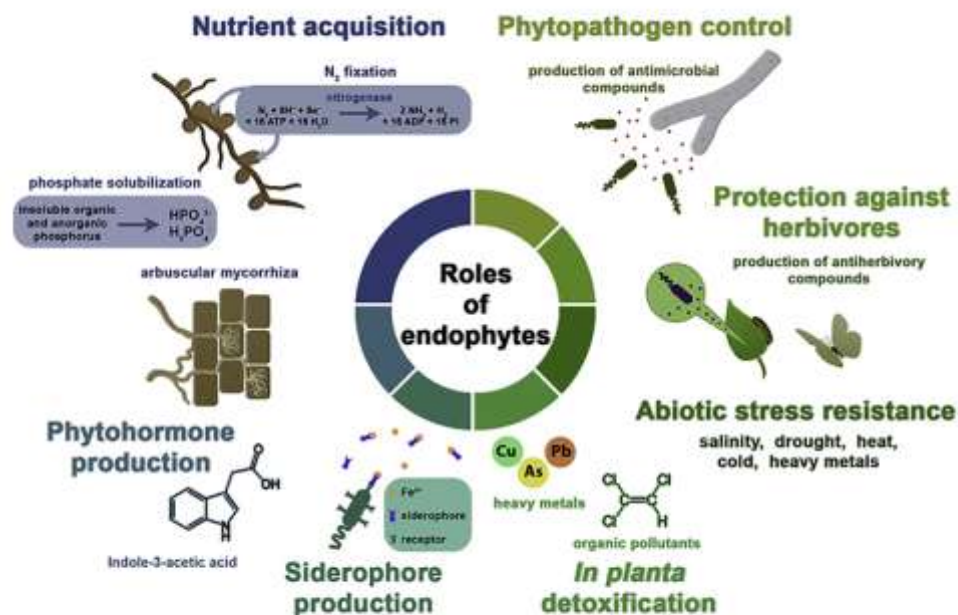


Plant colonization by endophytes



Anand et al., 2023 - <https://link.springer.com/article/10.1007/s00248-023-02190-1#citeas>





Papik et al., 2020
<https://www.sciencedirect.com/science/article/pii/S0734975020301166>



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Preparates for plants support

PHILOSOPHICAL TRANSACTIONS.

I. "Nitragin" and the Nodules of *Leguminosae* Plants.
 By MARIA DAWSON, D.Sc. (Lond. and Wales).
 Communicated by Professor H. MARSHALL WARD, F.R.S.

Received November 14.—Read December 5, 1909.

[PLATE I.]

THE investigations, which form the subject of this paper, were begun by me in the autumn of 1907, at the suggestion of Professor MARSHALL WARD.

My chief aim was to study the nature and properties of the so-called "nitragin," a patent green-fertiliser, recently introduced by Drs. STROMY and KERE for use in agriculture.

Heinrich Anton de Bary



Definition of endophyte

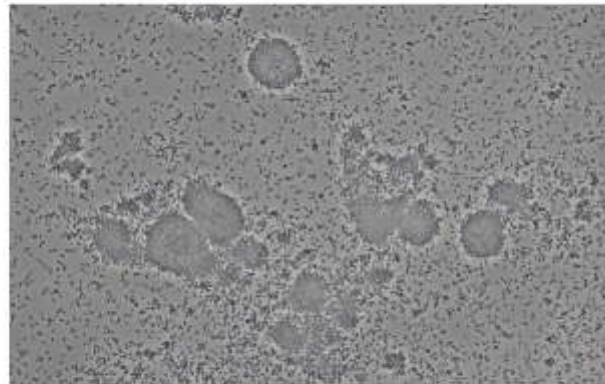
Nitragin – first on the market in 1896



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Pantoea agglomerans DBM 3797 - the hop (*Humulus lupulus*) endophyte



Symplasmata formation (biofilm like structures) by *Pantoea agglomerans*

Pataková et al., 2024

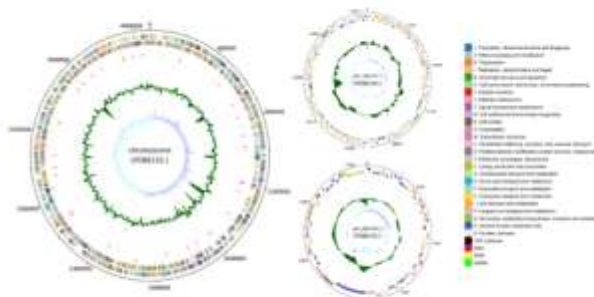
<https://www.frontiersin.org/journals/microbiology/articles/10.3389/fmicb.2024.1305338/full>



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Genomic versus phenotypic traits



A circular map of the chromosome (on the left) and both plasmid (on the right) sequences of *P. agglomerans* DBM 3797



Colonies on agar plate

Facultatively anaerobic metabolism, formation of acids, release of ammonia from amino acids

Plant growth promoting activities

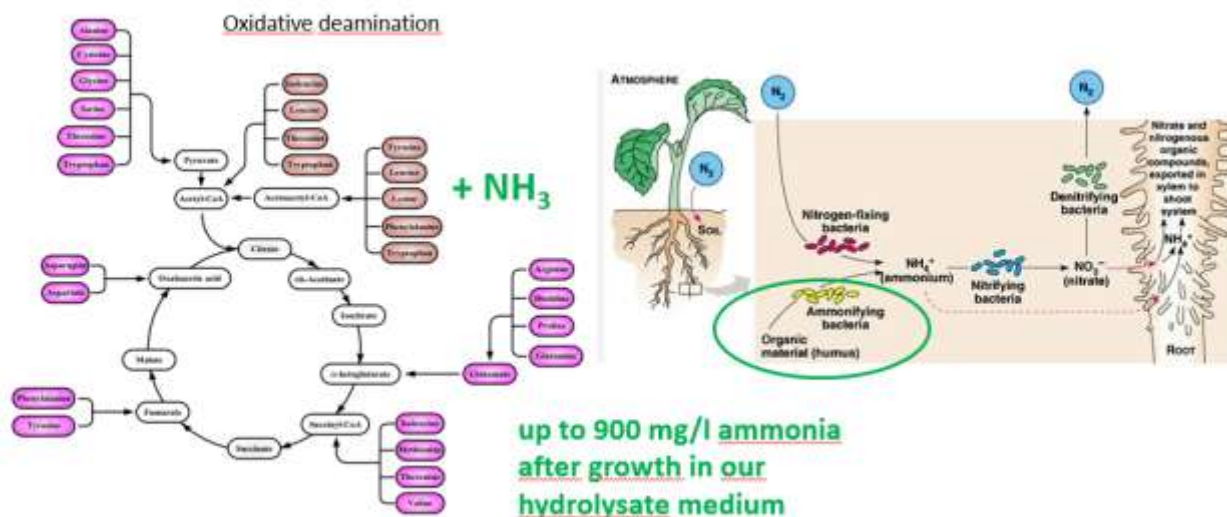
Phosphate solubilization	ND
Amylolytic activity	+
Lipolytic activity	+
Pectinase activity	+
Proteolytic/peptidase activity	+++
Cellulase activity	+++
Siderophore formation	++
Nitrogen fixation	ND
<u>IAA-like compounds production</u>	<u>++</u>



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Aerobic bacterial growth using amino acids as carbon source



Li et al., 2018 <https://link.springer.com/article/10.1186/s13068-018-1234-5>



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Appl Microbiol Biotechnol (2020) 104:8607–8619

8609

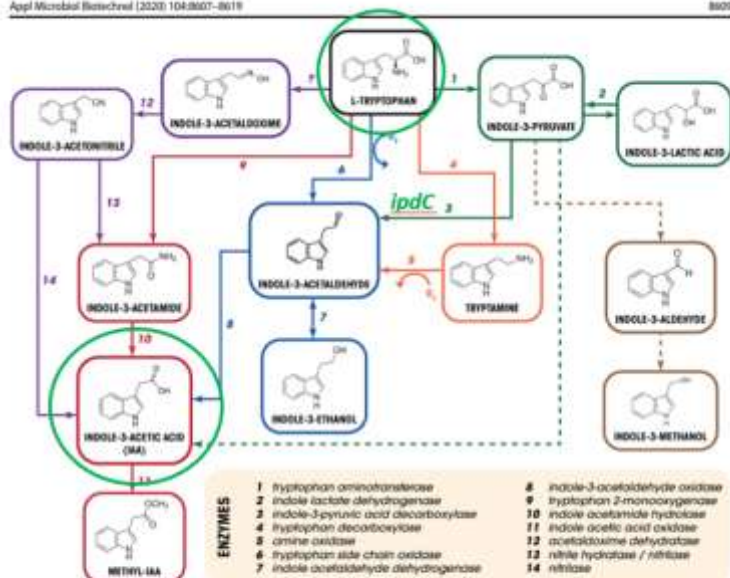


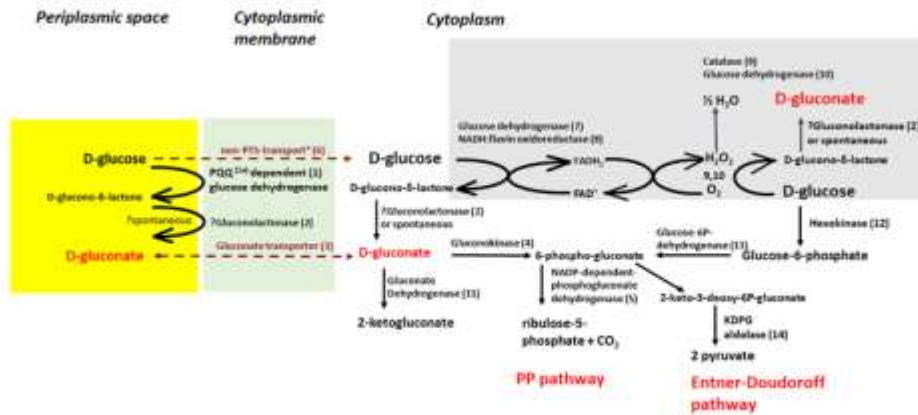
Fig. 1 IAA biosynthesis pathways in bacteria. Dashed lines represent reactions that occur non-enzymatically. Enzymes are labeled with respective numbers



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Reconstruction of gluconate metabolism in *Pantoea agglomerans*



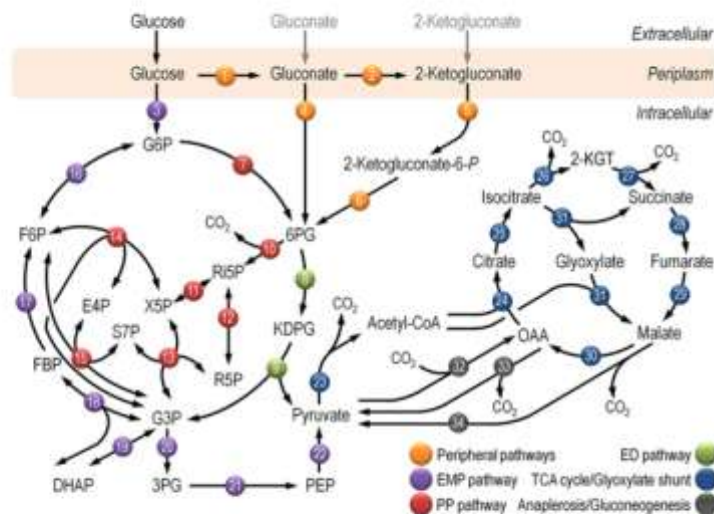
Gluconic acid production - defence against soil protozoa; phosphate solubilization



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Cyclic Glucose Metabolism in *P. putida*

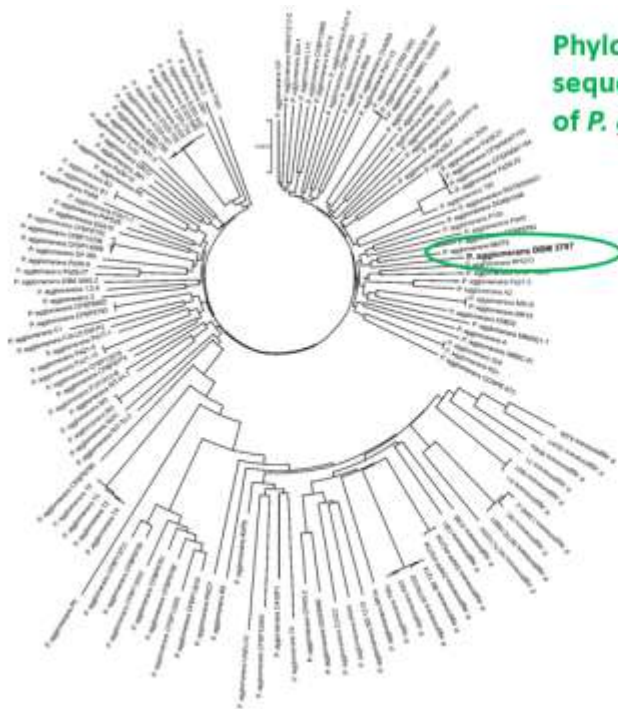


Nikel et al., 2015
<https://www.sciencedirect.com/science/article/pii/S00219258204957307via%3Dihub>



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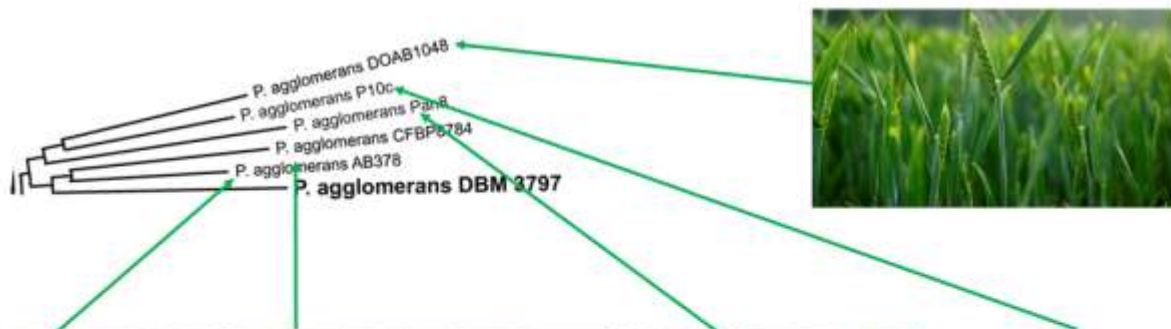
Phylogenomic analysis based on concatenated sequences of 2,399 core genes of 139 genomes of *P. agglomerans* strains

The tree includes:

- Phylosphere strains
- Soil strains
- Strains already used for PGP
- Pathogens (for people, for plants)



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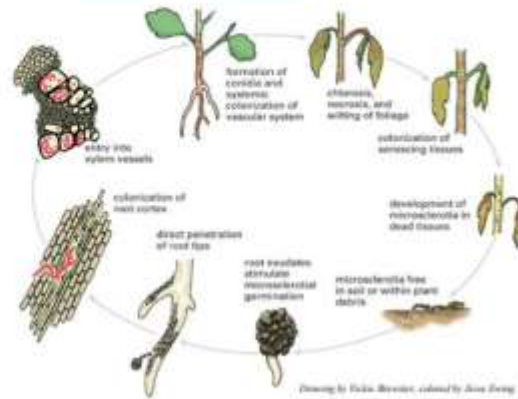
Future work - Testing antifungal properties of our *Pantoea*

Verticillium wilt



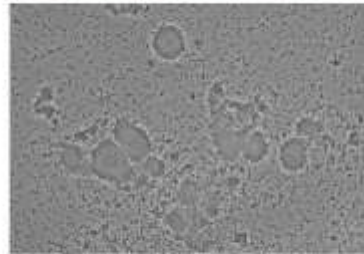
<https://zemedelec.cz/lonsky-vyzkum-prokazal-vyskyt-vadnuti-chmele-riziko-sireni-je-vysoke/>

Life cycle of Verticillium



<https://www.apsnet.org/edcenter/disandpath/fungalasco/pdlessons/Pages/VerticilliumWilt.aspx>

Many thanks to our microbial friend!



Thanks to project partners for great collaboration



Thanks for funding!