Seed endophyte communities in wheat

Spring wheat seeds of different geographical origins and the influence of storage conditions on the bacterial community

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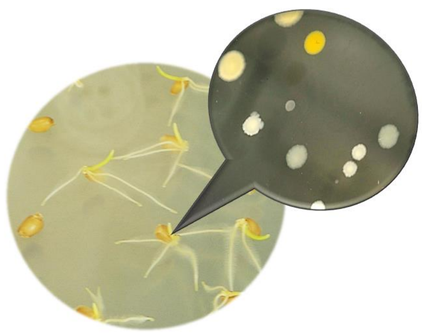
INTRODUCTION

Seed germination depends on the seeds longevity, dormancy and appropriate environmental conditions. Seed-associated microbiota like bacterial endophytes may play an important role in seed preservation and germination [1] [2]. Bacterial endophytes are known as mainly commensal plant colonizers; some can act as plant growth promotors or biocontol agents within their hosts. It is assumed that composition and performance of endophytes depend on the hosts genotype and condition, growth stage, plant tissue, soil conditions and associated microbiota [1] [3]. Seed endophytes are of particular interest as they are vertically transmitted to the progeny providing host-aligned potential germination promoting features for the next generation [1] [2].

In this study bacterial endophytes from spring wheat seeds with distinct seed longevity were characterized with focus on germination improvement by cultivation-dependent 16S rRNA gene analysis. Investigated seeds provided by the Genebank of IPK Gatersleben Germany, arose from distinct wheat accessions (genotypes), regenerated under similar environmental conditions, kept under different storage conditions.

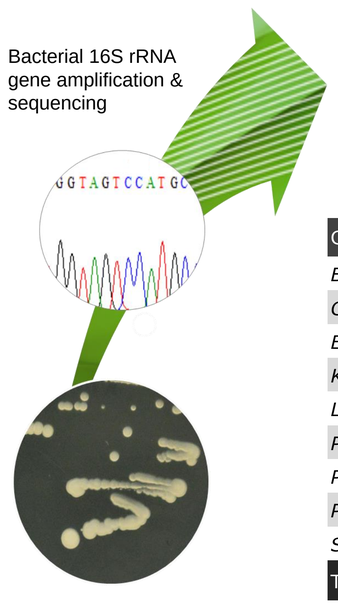
1. SEED SAMPLES

Germinated and not germinated spring wheat seeds with different longevity, expressed by distinct germination rates were used for bacterial endophyte isolation.



SEED LOT	ACCESSION	STORAGE	ORIGIN	GERMINATION (%)	REGENERATION
LLA	Long-living landrace	Room temperature	Armenia	81	2003
LLC	Long-living landrace	-18° C	Armenia	93	2003
KLA	Short-living landrace	Room temperature	Armenia	9	2003
KLC	Short-living landrace	-18° C	Armenia	92	2003
LZA	Long-living cultivar	Room temperature	Argentina	43	1998
LZC	Long-living cultivar	-18° C	Argentina	87	1998
KZA	Short-living cultivar	Room temperature	Mexico	22	1998
KZC	Short-living cultivar	-18° C	Mexico	89	1998

2. ISOLATED SEED ENDOPHYTES

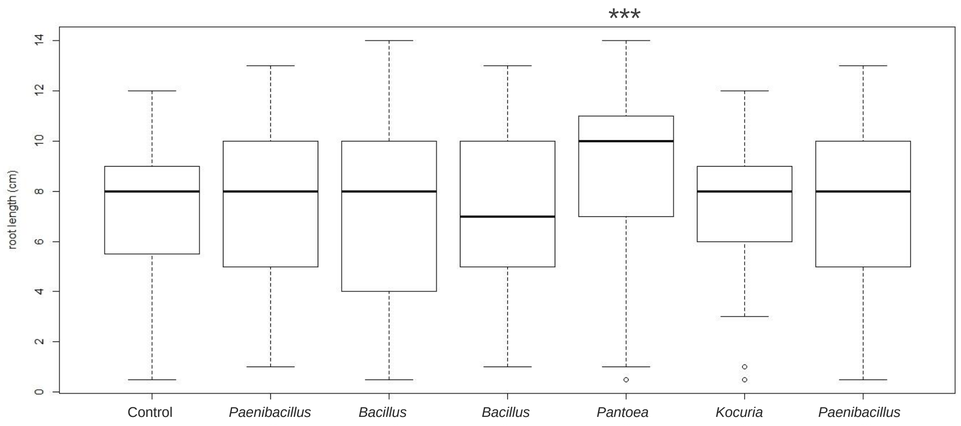


The highest bacterial diversity was observed in seeds from short-living cultivars with storage at - 18° C, the lowest in same seeds stored at room-temperature.

GENUS	LLA	LLC	KLA	KLC	LZA	LZC	KZA	KZC	TOTAL
Bacillus	-	-	6	5	2	3	1	5	22
Curtobacterium	15	12	-	-	-	-	-	-	27
Erwinia	-	-	-	-	-	-	-	8	8
Kocuria	-	1	-	-	-	-	-	-	1
Lysinibacillus	-	-	-	-	-	-	-	1	1
Paenibacillus	-	-	22	21	4	1	-	4	52
Pantoea	-	4	-	-	-	-	-	4	8
Pseudomonas	-	-	-	-	-	-	-	5	5
Shimazuella	-	-	-	1	-	-	-	-	1
TOTAL	15	17	28	27	6	4	1	27	125

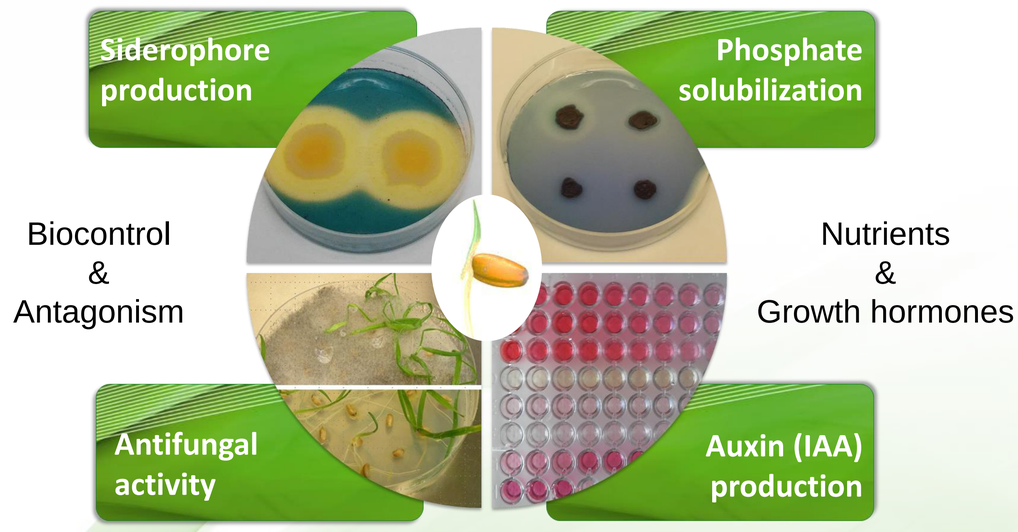
3. GERMINATION TESTS *IN VITRO*

Seeds from different spring wheat varieties were soaked in bacterial inocula. Some treatments resulted in increased germination rates or enhanced leaf-root elongation.



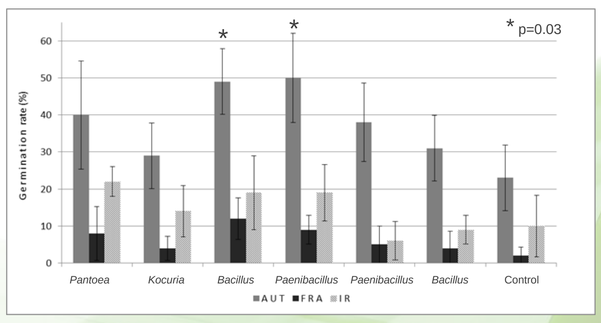
Root length (cm) of treated spring wheat seedlings n=479 *** p=0.0001

4. BACTERIAL TRAITS & BENEFICIAL EFFECTS



5. GREENHOUSE ASSAY

Selected bacteria applied to three spring wheat varieties, increased germination in soil.



6. CONCLUSION

- Spring wheat seeds with different longevity carry distinct sets of endophytic bacteria
- Wheat genotype and seed storage conditions affect cultivable bacterial seed endophyte composition
- Bacterial diversity and composition give no predictions about seed vigour and germination of the host
- Germination promoting bacteria can be found in spring wheat seeds of varying longevity expressed by distinct germination rates
- Germination promotion in endophyte-treated spring wheat seeds depend on plant genotype and test approach

REFERENCES

[1] Truyens et al. (2015): Bacterial seed endophytes: genera, vertical transmission and interaction with plants. Environmental Microbiology Reports 7: 40-50.

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