

## Seed Associated Microbial Communities of Holoparasitic Cistanche Species from Armenia and Portugal

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**Abstract :** Holoparasitic plants are flowering heterotrophic angiosperms which with the help of an absorbing organ - haustorium, attach to another plant, the so-called the host. Due to the different hosts, unusual lifestyle, lack of roots, chlorophylls and photosynthesis, these plants are interesting and unique study objects for global biodiversity. The seeds germination of the parasitic plants also is unique: they germinate only in response to germination stimulants, namely strigolactones produced by the root of an appropriate host. Resistance of the seeds on different environmental conditions allow them to stay viable in the soil for more than 20 years. Among the wide range of plant protection mechanisms the endophytic communities have a specific role. In this way, they have the potential to mitigate the impacts of adverse conditions such as soil salinization. The major objective of our study was to compare the bacterial endo-microbiomes from seeds of two holoparasitic plants from Orobanchaceae family, Cistanche - C. armena (Armenia) and C. phelypaea (Portugal) - from saline habitats different in soil water status. The research aimed to perform how environmental conditions influence on the diversity of the bacterial communities of C. armena and C. phelypaea seeds. This was achieved by comparison of the endophytic microbiomes of two species and isolation of culturable bacteria. A combination of culture-dependent and molecular techniques was employed for the identification of the seed endomicrobiome (culturable and unculturable). Using the V3-V4 hypervariable region of the 16S rRNA gene, four main taxa were identified: Proteobacteria, Actinobacteria, Bacteroidetes, Firmicutes, but the relative proportion of the taxa was different in each type of seed. Generally, sixteen phyla, 323 genera and 710 bacterial species were identified, mainly Gram negative, halotolerant bacteria with an environmental origin. However, also some unclassified and unexplored taxonomic groups were found in the seeds of both plants. 16S rRNA gene sequencing analysis from both species identified the gram positive, endospore forming, halotolerant and alkaliphile *Bacillus* spp. which suggests that the endophytic bacteria of examined seeds possess traits that are correlated with the natural habitat of their hosts. The cultivable seed endophytes from C. armena and C. phelypaea were rather similar, notwithstanding the big distances between their growth habitats - Armenia and Portugal. Although the seed endophytic microbiomes of C. armena and C. phelypaea contain a high number of common bacterial taxa, also remarkable differences exist. We demonstrated that the environmental conditions or abiotic stresses influence on diversity of the bacterial communities of holoparasitic seeds. To the best of our knowledge the research is the first report of endophytes from seeds of holoparasitic Cistanche armena and C. phelypaea plants.

**Keywords :** microbiome, parasitic plant, salinity, seeds

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