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Reciprocal interactions between plants and fluorescent pseudomonads
In relation with iron in the rhizosphere

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MATERIALS AND METHODS

Reciprocal interactions between plants and fluorescent pseudomonads
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Iron is an essential element for plants and microbes. Iron competition was demonstrated to be an important driver of the interactions between fluorescent pseudomonads and the rhizospheric microflora (Lemanceau et al., in press). To face this competition, plants and microorganisms have developed active strategies of iron uptake. In non graminaceous plants (strategy I), iron uptake relies on acidification and reduction of Fe(III) to Fe(II) which is incorporated into the roots by iron transporters (eg. IRT1). Active iron uptake by microorganisms relies on siderophores showing high affinity for iron.

We have previously shown that plants of Arabidopsis thaliana (strategy I) supplemented with Fe-pyoverdine had (i) a higher iron content than those supplemented with Fe-EDTA, (ii) iron incorporation from pyoverdine did not involve IRT1, and (iii) 57-N-labeled pyoverdine was incorporated in planta (Vansuyt et al., 2007). Taken together, these observations suggest that iron from Fe-pyoverdine was incorporated in planta not through the strategy I. In the present study, we explored possible mechanisms for incorporation of iron from pyoverdine at the cellular level.

RESULTS

Fe-pyoverdine localization in root

Confocal sections of root labeled with pyoverdine antibody clearly indicated pyoverdine presence in roots. Immunolocalization revealed the presence of pyoverdine in the root apoplasmic space.

Incorporation of Fe-pyoverdine by endocytosis?

Monitoring endocytosis by uptake of the endocytosis marker FM4-64 might indicate that incorporation of Fe-pyoverdine relies on endocytosis.

CONCLUSION

Observations and quantification with TEM showed a more abundant presence of vesicles in the root apoplasm of plants when cultured with Fe-pyoverdine than with Fe-EDTA. However pyoverdine immunogold labeling of root sections was not sensitive enough to allow the possible detection of pyoverdine in the vesicles. Altogether, these data confirm the acquisition of iron from Fe-pyoverdine by A. thaliana and suggest that iron incorporation from Fe-pyoverdine could be related to endocytosis. Further experimental proof is required to determine if the increase of vesicles in the presence of pyoverdine mediates that process.

References


References