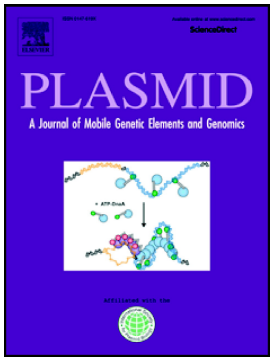

Conjugative plasmids enable the maintenance of low cost non-transmissible plasmids

Martin Werisch, Uta Berger, Thomas U. Berendonk

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Conjugative plasmids enable the maintenance of low cost non-transmissible plasmids

Martin Werisch [a] *, Uta Berger [a], Thomas U. Berendonk [b]

[a] Technische Universität Dresden, Department of Forest Sciences, Institute of Forest Growth and Forest Computer Sciences, Tharandt, 01735, Germany

[b] Technische Universität Dresden, Department of Hydro Sciences, Institute of Hydrobiology, Dresden, 01217, Germany

*Corresponding author: martin.werisch@tu-dresden.de

Abstract

Some plasmids can be transferred by conjugation to other bacterial hosts. But almost half of the plasmids are non-transmissible. These plasmid types can only be transmitted to the daughter cells of their host after bacterial fission. Previous studies suggest that non-transmissible plasmids become extinct in the absence of selection of their encoded traits, as plasmid-free bacteria are more competitive. Here, we aim to identify mechanisms that enable non-transmissible plasmids to persist, even if they are not beneficial. For this purpose, an individual-based model for plasmid population dynamics was set up and carefully tested for structural consistency and plausibility. Our results demonstrate that non-transmissible plasmids can be stably maintained in a population, even if they impose a substantial burden on their host cells growth. A prerequisite is the co-occurrence of an incompatible and costly conjugative plasmid type, which indirectly facilitates the preservation of the non-transmissible type. We suggest that this constellation might be considered as a potential mechanism maintaining plasmids and associated antibiotic resistances. It should be more deeply investigated in upcoming laboratory experiments.

Keywords

horizontal gene transfer; transfer competence regulation; plasmid incompatibility; plasmid persistence; plasmid interaction; individual-based simulation model

Highlights

- A new mechanism for the maintenance of non-transmissible plasmids is suggested
- A new individual-based model considering plasmid incompatibility and the switch of transfer competence is presented
- The model shows that non-transmissible plasmids can be maintained along with incompatible and costly conjugative plasmids
- Comprehensive model tests demonstrate the robustness of the proposed mechanism