Relationship between environmental conditions, carbon utilisation patterns and Niche Overlap Indices of the mycotoxigenic species Fusarium verticillioides and the biocontrol agent Clonostachys rosea

ABSTRACT

Recently, it was shown that a strain of the fungal antagonist *Clonostachys rosea* 016 was able to inhibit fumonisin B_1 mycotoxin production by *Fusarium verticillioides* FV1 when using different ratios of spores of each species *in vitro*. The objectives of the present work were therefore to: (a) compare the nutritional utilisation patterns and rates of uptake of key C-sources in maize by the antagonist *C. rosea* 016 and that by the pathogen *F. verticillioides* FV1; (b) examine their Niche Overlap Indices (NOI) under different interacting environmental conditions; and (c) evaluate whether the rate of utilisation of key maize C-sources influenced the competitiveness of either species using the Bioscreen®. It was found that water potential (Ψ) × temperature interactions had significant impacts on C-source utilisation patterns by *C. rosea* 016 and the pathogen. The NOIs, based on the utilisation of the C-sources by each strain divided by those utilised in common, showed that the antagonist and the pathogen occupied similar niches at −0.70 MPa Ψ+30 °C and −2.8 MPa Ψ+25 °C. Under the other conditions tested, they appeared to occupy separate niches suggesting niche exclusion. Temporal C-source utilisation patterns were then compared under different Ψ × temperature treatments. This showed that the dominant maize-based C-sources utilised by the pathogen and the antagonist were different. The pathogen *F. verticillioides* FV1 utilised carbohydrates rapidly followed by amino acids and then one fatty acid, palmitic acid. The antagonist *C. rosea* 016 utilised both carbohydrates and amino acids at a similar rate but more slowly than the pathogen. There were also differences in the utilisation of some individual amino acids and carbohydrates which might explain the occupation of different niches under some interacting environmental conditions. These findings are discussed in the context of why some competitors are able to inhibit mycotoxin production while others cannot.

Keyword: Biocontrol; Water potential; Carbon utilisation patterns; Niche overlap indices; Maize; Mycotoxins