

COMPLEMENTARITY IN DIVERSIFICATION SYSTEMS (FROM PLANT TO MARKET ECOSYSTEM). AN INTERDISCIPLINARY APPROACH

Jean-Noel Aubertot, M'hand Fares,
Jay-Ram Lamichhane, Jean-Marc Blazy, Jean-Joseph Minviel, Violaine Deythieux

Multi-infection interaction	Possible result of multi-infection interaction	Examples of multi-infections
	Competition : the development of the pathogen (A) reduces host resources availability for the pathogen (B) leading to a limitation of its development. In some cases this limitation can lead to competitive exclusion.	<ul style="list-style-type: none"> • <i>Trichoderma virens</i>, <i>Alternaria alternata</i>, <i>Epicoecum purpurascens</i> / <i>Sclerotinia sclerotiorum</i> (Mentier & Reuber, 1987) • Strains of <i>Phytophthora parasitica</i> and <i>Phoma medicaginis</i> var. <i>pinodella</i> (Dutt et al. 2007) • <i>Bacillus amylobacteres</i> / <i>Rhizoctonia solani</i> (Tan et al., 2015)
	Cooperation : both pathogens (A and B) reduce their development on their common host in order to favour their transmission to other hosts.	<ul style="list-style-type: none"> • Strains of <i>Phytophthora parasitica</i> and <i>Phoma medicaginis</i> var. <i>pinodella</i> (Dutt et al. 2007) • <i>Microbotryum lychnidis dioicae</i> (Tan et al., 2015)
	Cooperation : for its development the pathogen (A) produces components altering the host. This host modified tissue favours the development of the co-infected pathogen (B).	<ul style="list-style-type: none"> • <i>Pyrenopeziza thalictrivora</i> / <i>Puccinia thalictri</i> (Al-Naimi et al., 2005)
	Competition : the development of the pathogen (A) on its host can enhance host plants defense responses (A) against the other pathogen (B) leading to a limitation of its development, reproduction and/or transmission. In some cases this limitation can lead to competitive exclusion.	<ul style="list-style-type: none"> • Non pathogenic <i>Fusarium oxysporum</i> / pathogenic <i>Fusarium oxysporum</i> (Aini et al., 2013) • <i>Pseudomonas aphidis</i> / <i>Botrytis cinerea</i> (Buehler et al., 2013)
	Cooperation : the development of the pathogen (A) on its host can inhibit host plants defense responses (A) against the other pathogen (B) favouring its development, reproduction and/or transmission on the common host.	<ul style="list-style-type: none"> • <i>Pseudomonas syringae</i> / <i>Alternaria brassicicola</i> (Spool et al., 2007) • <i>Fusarium verticillioides</i> / <i>Agrospora oryzae</i>, <i>Acremonium asae</i>, <i>Phoma macrospora</i> (Saunders & Kohn, 2008)
	Competition : the pathogen (A) produces toxins (x) which may directly inhibit the development, the reproduction or the transmission of the co-infected pathogen (B) on the common host. In some cases this toxin production can lead to competitive exclusion.	<ul style="list-style-type: none"> • <i>Trichoderma gamsii</i>, <i>Fusarium oxysporum</i> / <i>Fusarium graminearum</i> (Sanzoco et al., 2018) • <i>Ascochyta fabae</i> / <i>Botrytis fabae</i> (Madena et al., 1992) • <i>Phoma</i> sp. / <i>Fusarium graminearum</i> (Moua et al., 2015) • <i>Enterobacter</i> sp. / <i>Fusarium graminearum</i> (Moua et al., 2016)

