Segmented co-infection of tree bark by different fungus

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Abstract

Co-existence of microbes in a community is the *de facto* state of microbial lifestyle in almost all niches on Earth. Thus, microbes live with other microbial species in close proximity, and evolution has selected for specific methods of communication between microbes that facilitated chemical cross-talk for understanding the identities of different microbes, and their relative antagonistic behaviour towards each other. Observation of different patches of dark and white on a tree bark highlights possible segmented co-infection of the bark with at least two different species of fungi. Although without clear boundary of separation between patches, antagonistic behaviour between the two species could not be ruled out. Other forms of interactions such as mutualism and symbiosis between the different fungal species could be elucidated with time of flight secondary ion mass spectrometry (TOF-SIMS) profiling of the biomolecules and chemicals mediating the communication highway between the microbes, whose identities could be determined by 16S rRNA sequencing.

Keywords: co-infection, microbial cross-talk, mutualism, symbiosis, time of flight secondary ion mass spectrometry (TOF-SIMS), antibiotics, antagonistic behaviour, microbial community, microbial communications,

Subject areas: ecology, botany, biochemistry, cell biology, microbiology,

Observation

Microbes inhabit many niches on the planet, some of which thought not to be suitable for life, such as hydrothermal vents in the deep oceans or under rocks in the Earth's crust. More importantly, single species of microbes do not inhabit a niche alone, rather, a diverse consortium of microorganisms would co-exist together in the same environment, performing various roles and functions, that in aggregate, enable the microbial community to fend off intruding species from other habitats, or to be better able to cope with fluctuating environmental conditions such as rainfall and temperature changes. Some of the functions performed by individual microbial species involve the synthesis and secretion of antibiotic compounds which defend the entire community against attack from microbes not present in the specific locale. Synthesis of such public goods by a specific set or species of microorganisms confer the species unique status in the microbial consortium, which makes their removal particularly detrimental to the entire community.

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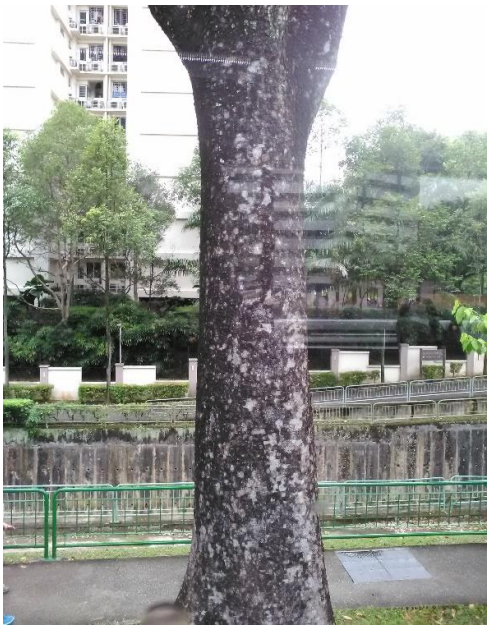

Figure 1: Patches of dark and white on a tree trunk highlight possible segmented co-infection of the tree bark with different fungus, which illustrates that different microbial species could co-exist on the tree trunk as a microbial community. Source of photo: Wenfa Ng

Patches of different colour and texture were observed on a tree bark in Singapore, which likely signifies the colonization of the tree bark by different fungal species. Specifically, the tree bark exhibited segmented co-infection by two main types of fungus that manifest in patches of dark and white on the textured tree bark (Figure 1). Such a microbial community may exhibit different states of competition or symbiosis (Figure 2). Specifically, while co-infection of the tree bark by two different species of fungi meant that the resistance of the tree to the fungal species is low, it also highlights that the two different fungal species could co-exist together either through a combination of mutualism or symbiosis. Alternatively, competition between the two fungal species could also manifest in the form of antibiotic warfare.

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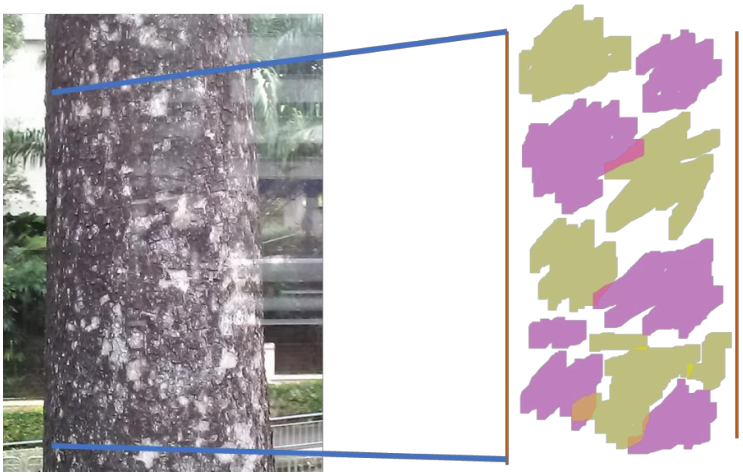

Figure 2: Existence of dark and white patches on the tree bark signifies that the two fungal species likely co-exist and co-infect the bark in an unknown way. While mutualism or symbiosis could be present between the two species, antagonism through antibiotic warfare is also possible. Source of photo and figure: Wenfa Ng

Possible ways for delineating the relationship between the microbes on the segmented infected tree bark include first: 16S rRNA sequencing for understanding the microbial species involved in the co-infection. Secondly, a relatively new form of mass spectrometry tool useful for profiling the type and relative abundance of the different types of chemicals and biomolecules mediating the chemical cross-talk between the different fungal species could be used on a sample of the tree bark. Known as liquid time of flight secondary ion mass spectrometry (TOF-SIMS),[1] [2] the technique is capable of high sensitivity detection of low concentration of small molecules and biomolecules important to mediating communication between cells in a microbial community. Finally, confocal laser scanning microscopy coupled with appropriate fluorescent labelling could be used to lend a lens to the overall community structure and spatial distribution of microbes on the tree bark sample.

Collectively, microbial community entangles a complex multi-species cross-talk in metabolites, signalling molecules, and secreted antibiotics, which is hard to discern through visual observation of the structure of the microbial community. Specifically, fierce competition for food that culminated in the regular use of antibiotics specific for each species may not manifest as sharp boundary of separation between different species of microbes in the community. In the case of segmented co-infection of tree bark by different species of fungi, visual observation of the alternating patches of dark and white colouration is unable to offer much clue to basic questions such as the identities of the microbes, and more importantly, what are they doing there? Thus, chemical profiling tools at the micro level such as liquid time of flight secondary ion mass spectrometry (TOF-SIMS) could lend a lens to the chemical cross-talk in metabolites, and signalling molecules between microbial species in a habitat. Coupled with confocal laser scanning microscopy visualization and 16S rRNA sequencing identification, both spatial distribution and identities of different strains and species of microbes could be determined.

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Conflicts of interest

The author declares no conflicts of interest.

Author's contribution

The author would like to share his thoughts on an observation he made concerning the possible occurrence of segmented co-infection of tree bark by different fungus. He wrote the manuscript.

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