Fungi in international wood trade, in the context of commodities, phytosanitary treatments and genomics-based detection tools

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Fungi that may be present on various traded wood commodities have increasingly been targeted by regulators around the world for their potential to be recognized as quarantine pests. Most focus in the past has been on insect pests and less on fungi. Insect species are known to have invasive potential but also they are relatively easy to detect and identify compared to fungi. Plant health inspectors are generally less familiar with fungi, which are more difficult to identify unless characteristic disease symptoms are present. This causes a serious problem since some of the most damaging forest epidemics have been caused by pathogens (e.g. white pine blister rust, Chestnut blight and Sudden Oak death). Plants for planting (including large trees for landscape, Christmas trees and forest nursery stock) are perceived as one of the most significant pathways for quarantine fungi. On the other hand fuel wood and wood packaging materials are recognised as significant pathway for insect pest but the risk for fungi remains unclear. Significance of other commodities such as round, sawn, chipped and processed wood (e.g. plywood, particleboards, engineered wood) is also under review. Phytosanitary treatments (e.g. heating at 56° C for 30 min or fumigation) combined with other integrated measures may significantly reduce fungal ability to spread and establish even though alone the treatments may not totally kill some target fungi. It has been argued that various pathogenic fungi can be present in particular wood commodity (that is not live plant), but have reduced risk of establishment because they either lack competitiveness or the ability to produce spores (fruiting bodies) and therefore do not have capacity to establish. The risk needs to be properly assessed and the ability to detect and track pathogens in the commodity and beyond is an important part of the process.
A new generation of genomics-based sensitive tools will be able to accurately detect a very small amount of fungal mass (e.g a few spores) through high input that can be used for certification of export products as well as to test imports. A large-scale multidisciplinary genomics project to enhance detection and monitoring of forest pathogens using next-generation high-throughput multiplex assays is currently being carried in Canada. Through consultation with national and international partners the project team has short listed the three most important forest pathogen groups: rusts, canker and blight causing fungi and root diseases for development of diagnostic assays. The genomes of 18 pathogens will be sequenced and compared to identify sets of genes that are 1) conserved within pathogen groups, 2) uniquely present within targeted species, and 3) specific to pathogenicity. These gene sets will define the genomic profiles of pathogens and be used to design hierarchical assays that will enable detection of both known and unknown (but potentially dangerous) pests. In addition the group will identify the 50 ‘most unwanted’ forest products pathogens for development of a customised tree-disease detection array. The practical feasibility and usefulness of such techniques for different commodities and under different scenarios will be discussed.

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