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Identification of Key Pathogens of Major Coastal Forest Weeds – FRDA Report 113

Bigleaf maple (Acer macrophyllum Pursh) and red alder (Alnus rubra Bong.) are trees common to coastal British Columbia. As two of the first colonizers of clear-cut and burned areas, red alder and bigleaf maple are considered weeds because they compete with commercial species.

Chemical herbicides and prescribed burning are silvicultural tools that are often used to control weeds after logging. But use of either burning or chemical spraying is under increasing scrutiny with mounting public concern over possible harmful effects.

Research is underway at the Pacific Forestry Centre in Victoria to develop biological methods for vegetation management in environmentally sensitive areas. The research has been directed at identifying candidate bioagents (mycoherbicides) from a choice of native or indigenous microorganisms.

Efforts have been directed at finding microorganisms on the weed species themselves. Although microorganisms with the desired disease-causing properties include bacteria, viruses, and obligate biotrophic fungi (those which grow only on living organisms), research is mainly directed towards the development of mycoherbicides based on facultative biotrophic fungi (i.e., fungi able to grow on both living plant tissues and dead substrates – saprophytically). The capacity of these fungi to cause disease is usually low because they have co-evolved with their respective host and, therefore, the host’s defense mechanisms are usually very well developed. In order to shift the balance of the disease-causing interaction in favour of the fungus, the researchers are developing an enhancement process.

Initially, the search for candidates was restricted to isolations of fungi from diseased plant tissues. This study was carried out to evaluate the possibility of finding some potentially pathogenic fungi within the population of endophytic fungi that inhabit plants on which disease symptoms are not evident. Indications are that most of the pathogenic fungi have a latency period during which they live endophytically in healthy plant tissues.

The examination of symptomless bigleaf maple and red alder tissues was found to be useful for finding candidate mycoherbicides. Three potentially pathogenic fungi have been found on bigleaf maple: Cryptodiaporthe hystrix, Diaportha eres, and Glomerella cingulata; and six on red alder: Diaportha eres, Gnomonia sotacea, Gnomoniella tubaeformis, Melanconis alni, Nectria sp., and Septoria alni. Pathogens expected but not found were Cryptosporiella depraedans (Cooke) Hoehn., Mycosphaerella mycophaga (Funk & Dorworth), Nectria cinabrina (Tode; Fr.) Fr., and Rhytisma punctatum (Pers.) Fr. on maple as well as Cercospora alni Dearn. & Barth, Didymosphaeria oregonensis Gooding, Encelia furfuracea (Roth; Pers.) Karst., Melanconis theoboldi (Fr.) Sacc., Nectria cinabrina, and N. ditissima Tul. on red alder.

This study showed once more that pathogenic fungi can be present in the host tissues even if there is no sign of disease. The plants are able to constrain these fungi at least until conditions become unfavourable for the plant. The shift of the equilibrium in favour of the fungi may depend very much on the species and can be caused by changes of atmospheric conditions, by a weakened or senescent host, by activation of “dormant” fungal genes, and possibly by alteration of the fungal genome.

The term “LDP” (Latent Disease Potential) was introduced for the first time as a device with which the potential of a known population of endophytic fungi to cause disease of a target host on a particular site could be estimated. This would be especially important when growth conditions were suboptimum for development of the plant and it was thereby weakened or “predisposed” to disease development. The LDP might then be extrapolated to provide guidelines as to the composition and concentration of mycoherbicide necessary to achieve target weed biocontrol.

* Definition of endophytic fungi

“Endophytic” or “endophyte” (from Greek “endo” = inside, “phytos” = plant) are, strictly speaking, positional expressions indicating that the organism is located inside plant tissue regardless of the health of the tissue, but the use of these expressions is usually restricted to organisms living inside plant tissues that do not exhibit disease symptoms at the moment of detection. In these studies, “endophyte” was used in the latter sense.

Copies of the 54-page report Identification of Key Pathogens of Major Coastal Forest Weeds, FRDA Report 113, by Thomas N. Sieber, Francesca Sieber-Canavesi and Charles E. Dorworth, are available, while supplies last from:

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Please request FRDA Report No. 113 when ordering.