



Forest insect and disease diagnostics

INTRODUCTION

As part of its role in the protection of Canada's forests, Natural Resources Canada, Canadian Forest Service (NRCan-CFS) develops tools to mitigate the spread and impact of native and alien forest pests. An important first step in pest management, particularly when dealing with new invasive species, is obtaining the correct identification of the insect or pathogen causing the problem. This is particularly critical for suspected alien species because their origin and alien nature must be confirmed so that responsible authorities and management options compliant with international agreements can be identified. Correct identification of

both alien and native species is also the gateway to all other scientific information associated with a species: its distribution, host range, biology, natural enemies, management options and potential impacts.

Taxonomy is the branch of science that deals with identification of organisms and diagnosis is the expert use of taxonomic characteristics to identify these organisms. Programs concerned with conservation of biodiversity, climate change and invasive alien species all require significant taxonomic support including experts that can perform diagnosis and museums that can maintain a reference collection that enables verification of identity.

GREAT LAKES FORESTRY CENTRE (GLFC) ROLE

Diagnostic services

GLFC provides identification services by staff members in both Ottawa and Sault Ste. Marie in support of the CFS pest management program. These services are requested by research scientists, the province of Ontario, the forest industry and, in some cases, the general public. Diagnostic services may be required for harmful pests as well as beneficial insects that can be used as control agents.

Insect and Disease Collections

Taxonomic literature and reference collections containing authoritatively identified specimens are key tools for accurate taxonomic



identification of insects and diseases. Insect identification specialists use reference collections to compare unknown specimens directly with known specimens to ensure they are correctly identified. Information from collection labels on the specimens is stored in databases, which allows it to be shared and ties all the CFS collections into a single source, available to all users. Databases also allow the synthesis of national historic data, which is helpful in studying issues such as species distribution, host range, pattern of spread and changes in prevalence.

Today, insect taxonomists and forest pathologists use an additional diagnostic tool. Once a specimen has been identified

its DNA fragments can be sequenced to produce diagnostic 'barcodes'. Once a barcode "library" is built and properly cross-referenced to existing species names, immature stages of an insect (the larvae, eggs, or pupae) for example, which are often impossible to identify based on morphology alone, can be identified, if a DNA barcode from the specimen of interest is available.

The GLFC Insect Collection

The insect collection housed at GLFC in Sault Ste. Marie was started in 1944 and contains over 160,000 specimens representing over 5,000 species that can be found feeding on forest trees and shrubs, or are parasites or predators of other insects throughout Ontario. Each specimen is identified by Insect Order, Family, Genus and Species, and is arranged alphabetically. The information is also entered into an electronic database, <http://www.glfcc.forestry.ca/glfccic-cicfg/i001.cfm?lang=eng>, which indicates where the insect is within the collection, and how many specimens there are. There are five Orders of insects represented in the collection: Lepidoptera (butterflies and moths, such as spruce budworm and gypsy moth), of which about 1730 species are represented; Coleoptera (beetles such as emerald ash borer and bark beetles) of which about 1500 species are represented; Hymenoptera (wasps and sawflies); Diptera (true flies such as mosquitoes); and, Heteroptera (true bugs such as plant bugs). All of these orders include some parasitoids of insects.

Complementing this collection is a collection of more than 100,000 forest insect specimens representing some 5000 species from across Canada, which is housed at the Canadian National Collection (CNC) in Ottawa. Over 12,000 Canadian specimens of bark beetles (Scolytidae – just over 5800) and round-headed wood borers (Buprestidae – almost 6500) in the CNC have now been added to the database and georeferenced by GLFC staff.

The GLFC Fungal Collection

The collection of fungi causing diseases in trees contains around 12,000 specimens, as well as approximately 500 live cultures. Specimens are from across Canada, with the majority being from Ontario. Information about each specimen in the collection, such as its classification, host species and geographic range, is being compiled into a database that will be available for public use.

CONCLUSION

Forest insect pests and diseases as well as beneficial insects that are used as natural control agents need to be accurately and rapidly identified as part of an effective pest management program. With increased international trade, the threat of invasive alien species has become more of a concern, to which prompt response is required. Accurate taxonomic identification is essential and requires the use of tools such as collections, diagnostic keys, images, barcodes, and databases. CFS taxonomists respond to requests from regulatory agencies and provinces and territories due to their expertise in the identification of forest pests. In addition, they collaborate with a world-wide network of taxonomists whose collective expertise spans the majority of insect groups.

PRINCIPAL COLLABORATORS

- Taxonomists at the Canadian National Insect Collection, Ottawa

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