

Chinese Ashes *Fraxinus* spp.

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Since its discovery in Detroit, Michigan, in 2002, the emerald ash borer (EAB), *Agrilus planipennis*, is estimated to have killed over 40 million ash trees in southeastern Canada and in 14 states throughout the central and eastern United States. Native to Asia, EAB probably arrived in North America by ship in solid wood materials used for packing freight. This insect's impact has cost municipalities, property owners, nursery operators, and the forest products industry tens of millions of dollars. It appears that no North American ash species is resistant to this pest, so all are threatened—there are an estimated 8 billion ash trees currently growing in the United States.

On the few ash species that have been studied in China, EAB is usually a secondary or periodic pest, infesting only stressed trees and not necessarily resulting in tree mortality. Most outbreaks in China have been associated with urban and restoration plantings involving North American species, particularly green ash (*Fraxinus pennsylvanica*) and velvet ash (*F. velutina*), both of which have been extensively planted in many northern Chinese cities.

It is extremely important to gain access to *Fraxinus* species from China to test the full range of EAB response and to assess the adaptation of Asian ash species to American conditions and their appropriateness for urban landscapes. There are 22 *Fraxinus* species listed in the *Flora of China*. Some of these species are tropical, and therefore not suitable for regions of the United States currently under siege by EAB, but they are of potential utility for expanding the range of ash adaptation or for responding to EAB if the pest proves to be adapted to tropical or subtropical areas in the New World.

During previous NACPEC expeditions, collecting *Fraxinus* species had not been a primary focus. Typically, there were too many other more exciting species to collect and there was no reason to focus on ash. With the invasion of EAB this changed. A 2006 NACPEC-sponsored grant request was funded by the USDA and supported contract collecting of native *Fraxinus* seeds in China by Kang Wang of the Beijing Botanic Garden from 2007 through 2010. Addi-



Collecting seeds of Manchurian ash (*Fraxinus mandshurica*) in China.

tionally, the 2008 NACPEC expedition to Shaanxi Province focused on collecting *Fraxinus* in the botanically rich Qinling mountain region. We collected several thousand seeds of five *Fraxinus* species there. Several of these species are poorly represented in the United States; for example, Pax's ash (*F. paxiana*) and island ash (*F. insularis*) are being grown at only two or three botanical institutions. We made several collections of these species, along with Chinese ash (*F. chinensis*), Manchurian ash (*F. mandshurica*), and Chinese flowering ash (*F. stylosa*). Of these, Manchurian ash is probably the best known, since it is a large-growing tree with an established landscape value (the cultivated selection 'Mancana' is common in the nursery industry). Other species, such as island ash and Chinese flowering ash, are medium-sized trees that may have urban use potential if they prove adaptable. Pax's ash is a shrubby species that possesses extremely large flower clusters, but its landscape potential is unknown.

Twenty-six *Fraxinus* seed collections have been made in China, resulting in 11 different taxa currently represented by over 600 plants. Ash seed is relatively easy to harvest, clean, and germinate, so the degree of success growing these plants has been good. Surplus seeds will be preserved in the USDA's germplasm repository in Ames, Iowa, and made available for scientific research throughout the world. Currently, plants from the 2008 Shaanxi expedition are being used by leading researchers in efforts to identify relative susceptibility and resistance of different ash species to EAB. The seed collections will also aid research in identifying appropriate genetic material to create new North American-Asian ash hybrids that combine resistance genes from the Asian species with useful characteristics from the North American species. Researchers Koch et al. recently cited the importance of the NACPEC *Fraxinus* collections to their genetics and breed-



Fraxinus insularis foliage and seeds.

ing efforts, noting that the previous lack of Asian ash accessions in the United States had greatly restricted the potential for hybridization. Future collecting expeditions are planned and many additional research questions related to EAB still need to be answered.

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