

# **A first in tree research: European trees planted in China to identify potentially invasive species in our forests**

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INRA scientists worked with colleagues from the Academy of Sciences in Beijing and the Zhejiang Agriculture and Forestry University to study the ability of Chinese insect and fungal pathogens to colonize European trees.

Most of the exotic species which attack plants in Europe now come from Asia. INRA scientists, together with teams from the Academy of Sciences in Beijing and the Forestry University in Zhejiang have devised a new method for detecting potential invaders in their region of origin before they are introduced on another continent. European sentinel trees were planted in China for four years, and during this period, the ability of Chinese insect and fungal pathogens to colonize these trees was studied. Two articles in *PLoS ONE* present the results of this study, including those dealing with insects, published online on 20 May 2015.

The expansion of international trade, rapid transport, increasing sales of decorative plants and agricultural goods, and global warming are all factors which contribute to the unintentional introduction and survival of organisms, fungi and insects in new geographical zones far from their region of origin. Often, these organisms do no damage in their country of origin thanks to the presence of natural enemies or resistance in their hosts. Though only a small fraction of accidentally introduced species become invasive, the financial costs to the agriculture and forestry industries are significant and risks to human health (via the tiger

mosquito, for example) and biodiversity (e.g. Asian wasps, Asian long-horned beetle) can result.

## **An original experiment**

INRA scientists planted seven species of European trees: five broadleaved (hornbeam, beech and three species of oak) and two conifer (cypress and pine) at two sites in China (one near Beijing and another in Fuyang, Hangzhou). One hundred trees of each species, initially measuring about 1.5 metres, were planted at each site in adjoining lots of 25 plants each. In total, 400 trees were planted at the Beijing site and 700 at the Fuyang site. Between 2007 and 2011, researchers regularly monitored the colonization of these trees by Chinese insects and fungi closely.

Over the course of this four-year period, every two weeks at Fuyang and monthly at the Beijing site, each tree was examined to identify and count adult insects and larvae and any damage found. The insects were then collected. Different types of damage to foliage, buds, branches or trunks were noted and photographed. Using reared insects, researchers then tried to link each type of damage to the insects present, and larvae and adult insects were kept for taxonomic and genetic identification.

## **104 insect species, 38 of which are potentially invasive**

In total, 104 [insect species](#) were observed on the new host trees. Some simply ate the leaves of the trees on an occasional basis, but 38 species caused multiple colonisations – on the sessile oak, primarily – and demonstrated that at least six species could produce larval development on European trees. These 38 species are considered to be potentially invasive if they are introduced in Europe. Surprisingly, most of these [species](#) appear to be originally linked to agriculture and fruit trees rather

than neighbouring forest trees.

A maximal rate of colonization took three years. As such, nearly all the trees survived the first year. After that, the mortality rate was significantly high at both sites, though important differences were noted between varieties. After three years of testing, only 99 of the 400 trees planted at the Beijing site were still alive: all but four of the conifers were dead but half of the oaks survived. At the Fuyang site, after being planted two years, the sessile oak was the only variety with a survival rate of nearly 50%.

Additional results on the colonisation of these European [trees](#) by [fungal pathogens](#) native to China were recently published in the same journal by a consortium of scientists from INRA, Viterbo University in Italy and the Academy of Sciences in China (Vettraino et al. *PloS One* 10(3): e0120571).

The sentinel tree method appears to be promising, and its possible use in other contexts is being examined within the framework of GLOBAL WARMING, an EU COST project. One major stumbling block is the difficulty of identifying [insects](#), particularly at the larva stage, and pathogens using standard methods. This could be solved by developing molecular databases.

**More information:** "Planting sentinel European trees in Eastern Asia as a novel method to identify potential insect pest invaders," *Plos One*: [journals.plos.org/plosone/arti ... journal.pone.0120864](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0120864)

Provided by INRA

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