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Not a single year goes by without European forests being invaded by new alien species of insect herbivore or pathogenic fungi. This ever-increasing flow of alien pests (Santini et al. 2013; Roques et al. 2020) is clearly linked to the increase in international trade, in particular to containers containing wood packaging material such as wooden crates, dunnage, pallets, or potted plants where wood- or plant-living insects and pathogens can hide (Meurisse et al. 2019). In 2021, about 60 million containers arrived in European ports (Eurostat 2022), more than 150,000 every day. The largest container ships are now 400 m long and carry more than 20,000 containers on each trip. It is obvious that the inspection effort, although reinforced, cannot deal with such an impressive amount of commodities and it is very unlikely that the flow of international trade will decrease in the years to come owing to our globalized economy. Global warming will certainly not help because new and shorter sea routes are opening up with the melting of the Arctic ice. An increasing proportion of freight in Europe comes from South America, Africa and especially Asia (Eurostat 2022), all hot regions, and the increase in temperatures in Europe may facilitate their establishment. Damage caused by these exotic pests and diseases affects the survival and growth of trees, altering the functioning of forests and thus jeopardizing the multiple ecosystem services they provide. In addition, eradication and management costs of non-native forest pests are considerable. A recent study has shown that the economic cost of biological invasions is of the same magnitude as that of natural disasters (like storms or wildfires). They have been multiplied by 8 between 1980–2000 and 2000–2020, amounting to more than 1,000 billion dollars (Turbelin et al. 2023). Because forests provide irreplaceable goods and materials for people and the European economy, because maintaining healthy forests is essential for their contribution to climate change mitigation through sequestration and storage of atmospheric carbon, it is urgent to develop more effective protective measures against the ever-increasing threat of invasive forest pests.

The invasion process has four main stages, starting with the arrival of individuals (propagules) in a new territory, sometimes followed by a phase of establishment of a population, and its development in an epidemic phase, and finally its geographical expansion (Paap et al. 2022). The principle of preventing the risks associated with these invasive species is to hinder the transition from one phase to the next as quickly and effectively as possible. In this context, the role of researchers is to develop, test and promote the most relevant methods and tools at each stage of the invasion framework, i.e., for the early detection of these invasive alien organisms, for the identification of the species and for the monitoring of their damage and spread, but also for new eradication and control solutions. These are the principles that the European project HOMED (https://homed-project.eu) has applied since 2018 in partnership with 23 research organizations in Europe but also in Australia, China, New Zealand, South Africa and the United States, as they represent the regions of origin of many invasive species in the European forests. This project also benefited from a close collaboration between forest entomologists and pathologists, which was very useful because insects and pathogens often share the same host trees and invasion pathways, or frequently have biotic interactions. The two disciplines are complementary in terms of scales of analysis and investigation methods (Jactel et al. 2020). This project has led to major advances in the management of invasive pests in forests, as illustrated by the 16 articles collected in this special issue of NeoBiota. These publications address the four main stages of the invasion process and its management.

The first phase is the one preceding the arrival of the alien species in the new territory during which the pre-border biosecurity approach is put in place. This is during this preliminary phase when it is necessary to reinforce the preparedness of managers to the risk of invasion and try to identify the alien species likely to invade the territory exposed to the risk. The adoption by a large range of end-users (from customs to nurseries and forest enterprises) of technological innovations for the management of invasive species is highly dependent on the awareness of these organisms by the multiple actors involved in quarantine inspection, management of forest and forest health, plant nurseries, urban parks, garden centres, etc. The adequacy of these new tools also requires attention to the real needs of these stakeholders. This is revealed by the survey conducted among many forest health stakeholders in 15 European countries (Green et al. 2023). When invasive alien pests are known, the susceptibility of potentially exposed woody species can be assessed using sentinel plantations ex patria, i.e., in areas where these pests are already present. This approach is illustrated by Paap et al. (2023) for the Myrtle rust and by Casarin et al. (2023) for the bacterium *Xylella fastidiosa*. From a risk assessment perspective, it is essential to establish the diversity of invasive species known to be harmful to trees as well as their traits or pathways favouring their invasive potential, such as cosmopolitan bark beetles (Grégoire et al. 2023), Buprestidae (Ruzzier et al. 2023), or even all the exotic pests associated with a particular tree species such as the radiata pine (Brockerhoff et al. 2023).

The second phase corresponds to the arrival of invasive species in the new territory, for example exotic pests in European forests. Here, it is necessary to detect them as early and efficiently as possible in order to quickly trigger eradication measures. Trapping methods with generic attractants have been shown to be very relevant for the detection of exotic bark beetles in high-risk areas such as ports and airports (Roques et al. 2023), or with the help of vigilant citizens such as school children (Colombari and Battisti 2023). Rotating spore traps have given encouraging results to detect fungal pathogens such as the one causing ash dieback (Dvořák et al. 2023). Many invasive pathogens go unnoticed in their establishment phase or cause non-specific symptoms. It is therefore very important to have reliable and rapid methods to identify them. For example, molecular methods such as LAMP or real-time PCR allow the simultaneous detection of different organisms, such as *Ophiostoma novo-ulmi* and *Geosmithia* spp. in elm plants or bark beetle vectors (Pepori et al. 2023). The presence of invasive species can also be detected through advanced imaging techniques. For example, the winter nests of the pine processionary moth can now be more accurately detected by drone images analysed by artificial intelligence algorithms (Garcia et al. 2023).

The third phase involves the establishment of invasive species in the new territory, a process that is intended to be interrupted by eradication measures. However, eradication is often complicated and not always accepted by the citizens. A systematic review of the literature has identified the main causes of failure and success of eradication attempts of woody plant pests in Europe, allowing also recommendations for successful implementation (Branco et al. 2023).

The fourth phase starts if eradication measures were not successful and therefore it is necessary to move to long-term management of established populations by limiting their expansion and damage. In particular, studies must be conducted on the climatic conditions and the quantity and vulnerability of host trees that favour the spread of diseases, as shown with the maple sooty disease (Muller et al. 2023) or the small spruce bark beetle (Cocos et al. 2023). Spread models can also be developed to test the role of various potential factors on spread (e.g. human-mediated dispersal, urban trees), and thus better predict the rate and direction of spread of invasive species such as the citrus psyllid (Nunes et al. 2023). Finally, control actions must be considered for the containment of populations of exotic species that have become established in European forests. An interesting solution is that of conservation biological control, which is based on the principle of reinforcing native and generalist natural enemies capable of controlling the populations of new exotic prey. More generally, forest diversification can induce associational resistance by intermingling host and non-host species, leading to less damage from exotic species, as shown in the case of the Douglas-fir midge and Swiss rust (Stemmelen et al. 2023).

The publications collected in this special issue demonstrate that current conceptual, methodological, and technological advances allow a great progress in the anticipation, monitoring and management of invasive pest species in forests. However, it should be noted that each of them, taken alone, is not sufficient to significantly reduce the risk of pest invasion. It is their combination, in a coherent whole, which will effectively reduce the impact of the invasive species on European forests. We therefore call on the community of researchers and practitioners to work together to develop a real strategy for monitoring and managing non-native forest pests by deploying at each stage of the invasion and in the areas at risk, the tools and methods that we contributed to improve or develop. As non-native species can arrive in different parts of Europe, can be highly mobile, borders are not impermeable, and European forests are themselves often transboundary, it is obvious that these strategies should be applied continent-wide. Mobilisation of communities beyond the forest sector and international scientific cooperation should therefore be pursued. It is also necessary to continue to harmonize national biosecurity policies and ideally to establish a European task force capable of reacting rapidly to the arrival or spread of new non-native forest pests, by not only assessing the associated risk and but also proposing actions for detection, surveillance, and control.

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