Forest protection against insect pests: utilizing plant defense strategies to our favour

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As a global society, we are entering an unprecedented era of increasing risk of pest damage. Global trade and climate change have, and will continue, to exacerbate the likelihood of novel threats and severity of damage to our forest ecosystems. Sweden is no exception, and we have already experienced the consequences of a recent warm and dry summer. Increased mortality of forest seedlings to native weevils feeding on conifer bark and needles, bark beetle outbreaks on mature trees, among others, are two of the ecological effects resulting in biomass and economic losses after only one summer. At the same time, the demand for forest raw material and greater forest productivity is steadily increasing as we strive to develop and support a global bioeconomy. To achieve these goals requires reforestation material that actually survives biotic threats, and becomes the final harvested stand. So far, we have relied to a large extent on the use of pesticides to protect our plants from various pests. However, industries, governments and society as a whole aim to shift away from the use of pesticides for environmental, human health and biodiversity reasons. How can we then ensure healthy forests and decrease vulnerability to current and future threats?

To achieve long term biosecurity of forest trees, we can exploit their inherent defenses against pests. To protect themselves, plants use two complementary strategies known as resistance and tolerance. Resistance allows plants to fight back by means of traits that prevent or reduce damage, such as toxic secondary compounds and spines. While tolerance allows plants to withstand attack through traits that buffer against the negative effects of damage, such as compensatory growth and wound healing. In my research, I investigate how we can make use of these intrinsic defense strategies to develop sustainable and novel methods of plant protection. The need for such approaches is urgent especially for forest trees, as they are long-lived organisms and what we are planting today will need to grow in the near and distant future. In collaboration with academic and industry partners, I seek to provide strategies that enable trees to survive attack during their most vulnerable stage as seedlings, but can also be prepared to better endure attack at later stages. As a plant-insect model system, I focus on Europe's major forest regeneration pest, the pine weevil *Hylobius abietis*, which feeds on the tender bark of conifer seedlings and can cause high levels of mortality and economic losses. Nonetheless, the knowledge generated on factors and processes that determine the amount of pest damage and how to minimize the consequences of such damage, has broader implications for various types of plant-insect interactions.

In my lecture, I will guide you through different ways in which we can use valuable ecological knowledge on plant defense to improve forest protection against insect pests, and how it has the potential to be combined with various emerging approaches in plant breeding, biotechnology, and other disciplines to ensure forest health. Thus, strengthening the likelihood that our forest ecosystems can meet current and future demands.