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BIOL 305L Spring 2020
Laboratory Eight
Computer based herbivory investigation

Introduction

Plants form the template on which communities and ecosystems are assembled and on which food webs are built. Thus, understanding the factors that determine plant distribution and abundance is central for our understanding of ecology at large (Maron and Crone, 2006). However, stating that, there any still many unanswered questions.

Why have some plants evolved to resist herbivory while others are less defended, but able to tolerate larger amounts of damage? Do these two components of defense, resistance (avoiding being eaten) and tolerance (enduring being eaten), differ in their relationships to growth and reproduction, and when are they likely to co-occur? Do herbivores select for tolerant plants or is tolerance a by-product of selection from plant competitors? Does tolerance fundamentally differ from resistance in its impacts on herbivore population dynamics and effects on higher trophic levels?

Plant biologists do have an understanding of the initial biochemical reactions which are involved in herbivory. The production of calcium oxalate crystals in response to insect attack have been known for – a few years now (Weber, 1891). Derivatives of Jasmonate - mostly Jasmonic Acid (JA) and Methyl Jasmonic Acid (MJA) – are known to regulate numerious plant processes and are critical for defence against herbivory (Farmer and Ryan, 1990). In addition, the network of signally pathways of plant responces to herbivores cotinues to unravel all of its many biochemical reactions (Arimura, *et al*. 2011). The role of secondary metabolites are also now becoming clear, after many years of plant biologists thinking they had no role in general plant functionality, in the network of plant responses against herbivores.

This type of computer-based investigation of herbivory is based upon the work of Ernest (2005). In this Lab you will work towards an understanding of the general herbivory defenses plants employ to be resistant or tolerant of herbivores. In addition, you will understand the cost, in terms of investment of photosynthetic output, to resistant, tolerant, and susceptible plants.

There is an optimal defense theory which considers cost benefits in terms of photosynthetic output to resistant, tolerant, and susceptible plants to attack by herbivores (Morales, *et al.*, 2016). Explain this theory and state all the pros and cons to these three states a plant can exist in. **Cite at least two primary literature articles.**

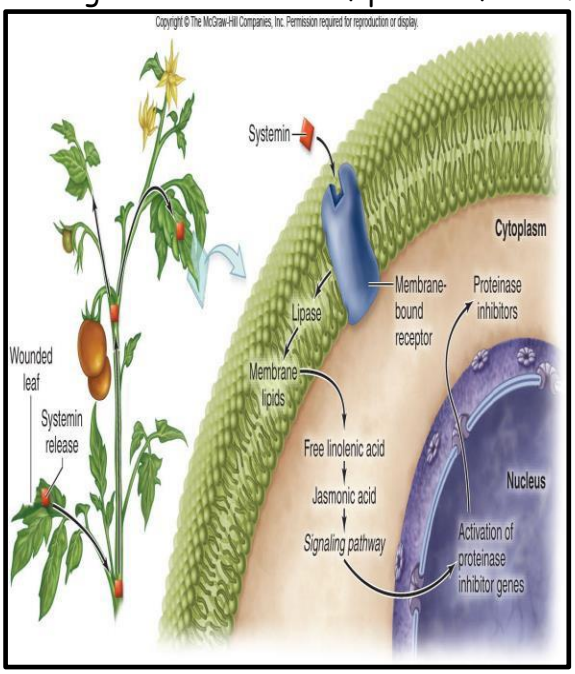
Plants have developed three principle groups of secondary metabolites. Fully explain what these are and how they work at either a structural level or as induces of defenses mechanisms. **Cite at least two primary literature articles for each example.**

Terpens:

Phenolics:

N-containing secondary compounds:

Jasmonic Acid (JA) and Methyl Jasmonic Acid (MJA) activates genes involved in a plants response to herbivores. Fully describe the events leading to the induction of plant defences. **Cite at least two primary literature articles**.



Fully explain the production and function of phytoalexins, including the synthesis of these compounds from the phenylpropanoid pathway. **Cite at least two primary literature articles**.

Calcium ions (Ca^{2+}) are part of the initial signaling network for plant defense responses to herbivores (Arimura G-I., *et al.*, 2011). Fully explain the workings of Ca^{2+} ion channels in plants. **Cite at least two primary literature articles**.

References

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