

Shaping the Future of Agriculture:

Biomimetic Non-toxic Species-specific Insect Repellents for Agricultural Plants

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Post-pandemic recovery plans also need to address biodiversity loss (McElwee, 2020). In agriculture, a related major contribution would be to make the transition from chemical, potentially toxic pesticides that affect the target species with intended consequences and that affect further life forms with unintended consequences by physical pesticides that solely repel the target species, without interruptions to other organisms including humans.

Biomimetics is the field of research that investigates living nature by trying to understand its basic principles and transfers them into technology for the development of solutions, products and/or applications. Various plants produce insect repellents based on wax micro- and nanostructures that exhibit specific mechanical and structural properties, such as finely tuned fracture behavior, thereby preventing insect attachment (Borodich et al., 2010). As England and co-workers showed in 2016 surface roughness rather than surface chemistry essentially affects insect adhesion (England et al., 2016). This is an example for the biomimetic principle that in living nature often structure is more important than specific materials to achieve certain functionalities. One further example for this principle are structural colors in various butterflies, where periodic, regular nanostructures yield brilliant, non-bleaching colors that can easily be transferred to technological surfaces via stamping (Zobl et al., 2016).

The keynote presentation will illustrate how the research of specific structures that can be transferred from one successful plant species to others can be a non-toxic alternative to chemical pesticides. In that case physics (structure) rather than chemistry (material) can offer a modern approach for the protection of crops in modern agriculture against harmful organisms and contribute to shaping the future of agriculture towards targeted insect repellents.

McElwee P. *et al.* "Ensuring a Post-COVID economic agenda tackles global biodiversity loss", *One Earth* (2020) 3(4): 448-461, <https://doi.org/10.1016/j.oneear.2020.09.011>

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