



Photosensitizer Insecticide – When Light Can Kill

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Need for alternative pesticides

Sustainable food production requires the successful management of pests and diseases. Insects have developed diverse resistance mechanisms against conventional insecticides at increasing rates, creating a need for exploring alternative insecticides with unique modes of action as part of an integrated pest management (IPM) strategy.

Recently Suncor AgroScience developed novel chlorin-based photosensitizer (PS) formulations, derivatives of non-toxic natural compounds, which show a potential against various economically important pests.

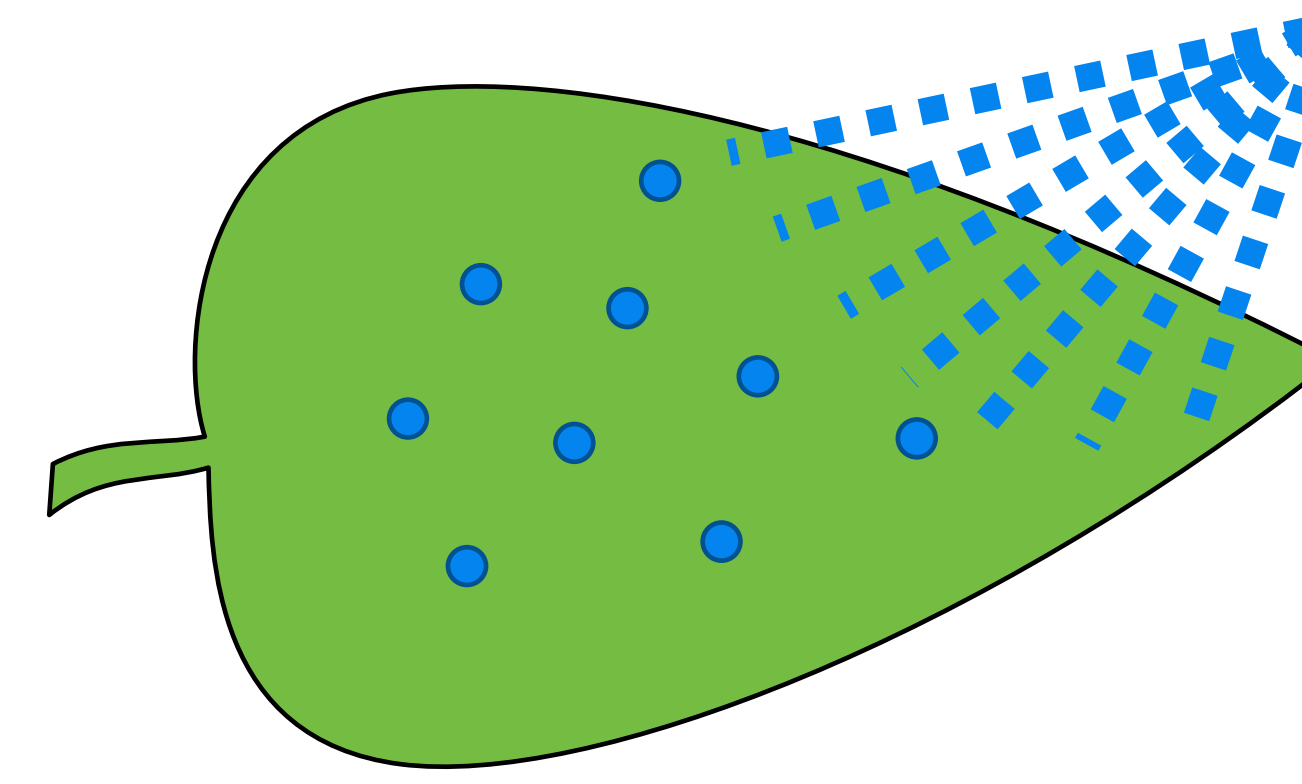
Unique mode of action

When photosensitizers in their ground state are activated by visible light radiation, the PS enter an excited state, producing reactive oxygen species (ROS). The formation of these highly reactive oxygen radicals causes physiological damage in the target pest, eventually killing it (Fig 1).

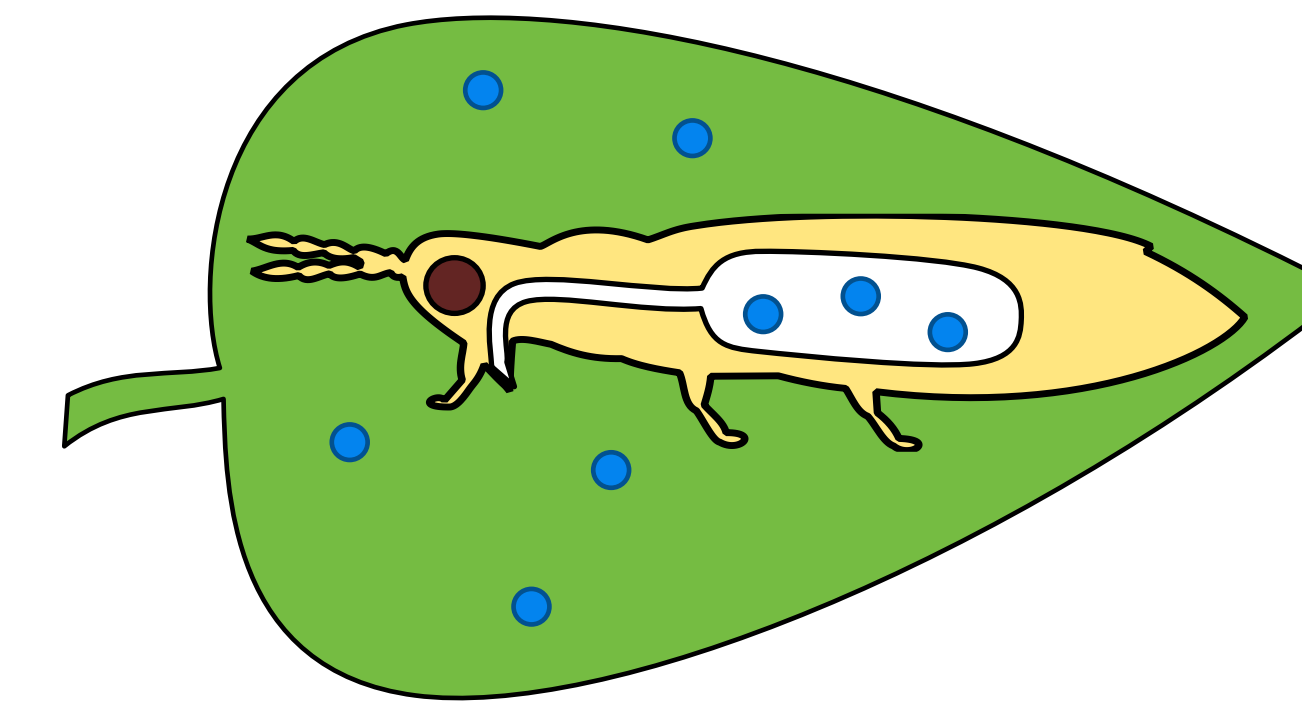
Benefits

- Due to their unique mode of action, the risk of pests developing resistance to photosensitizers is very low
- Light-activated insecticides could meet requirements as reduced-risk pesticides to be used in field and greenhouse vegetable, fruit and ornamental crops production
- PS that are effective in causing insect mortality are not harmful to human health (safe for workers)

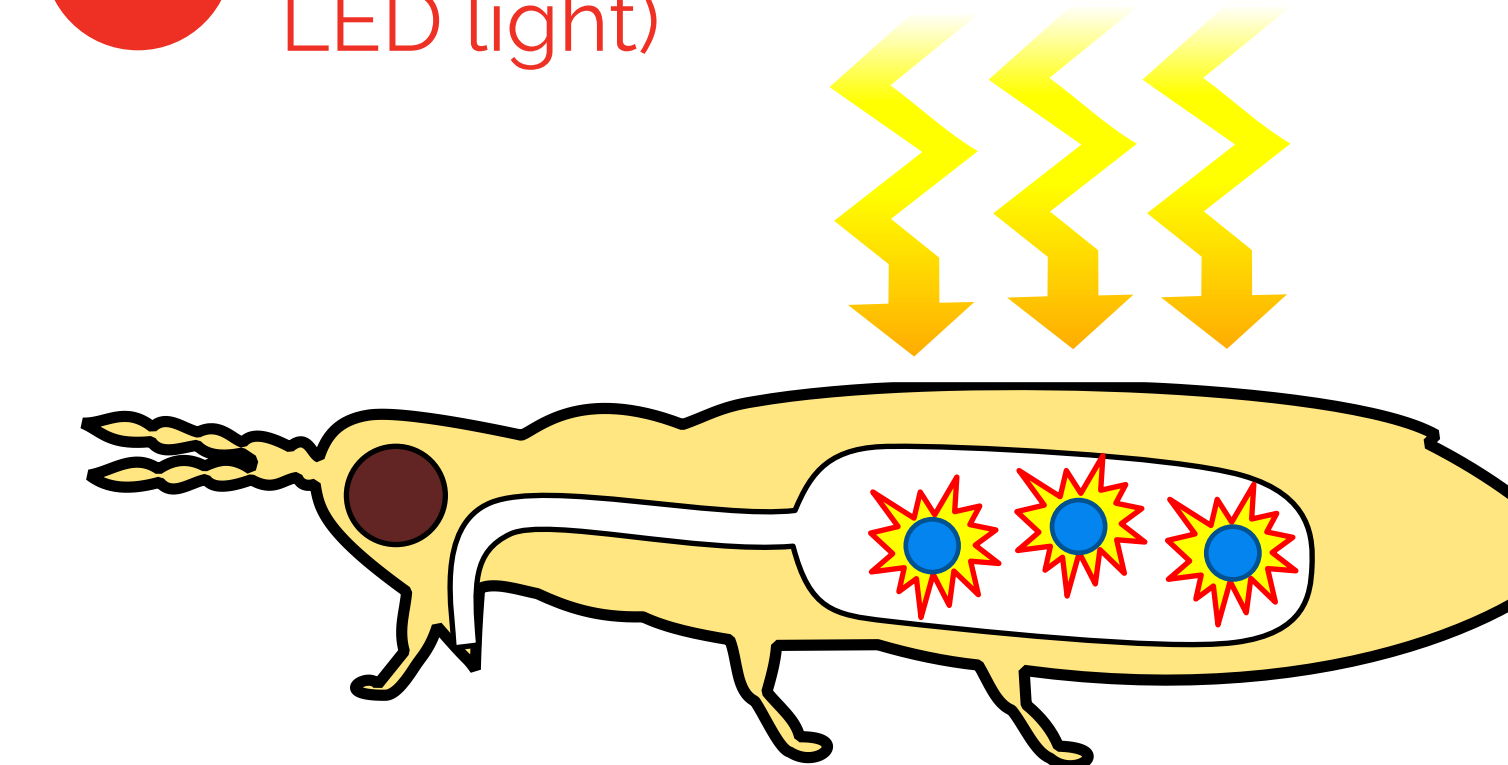
1 Spray plants with photosensitizer



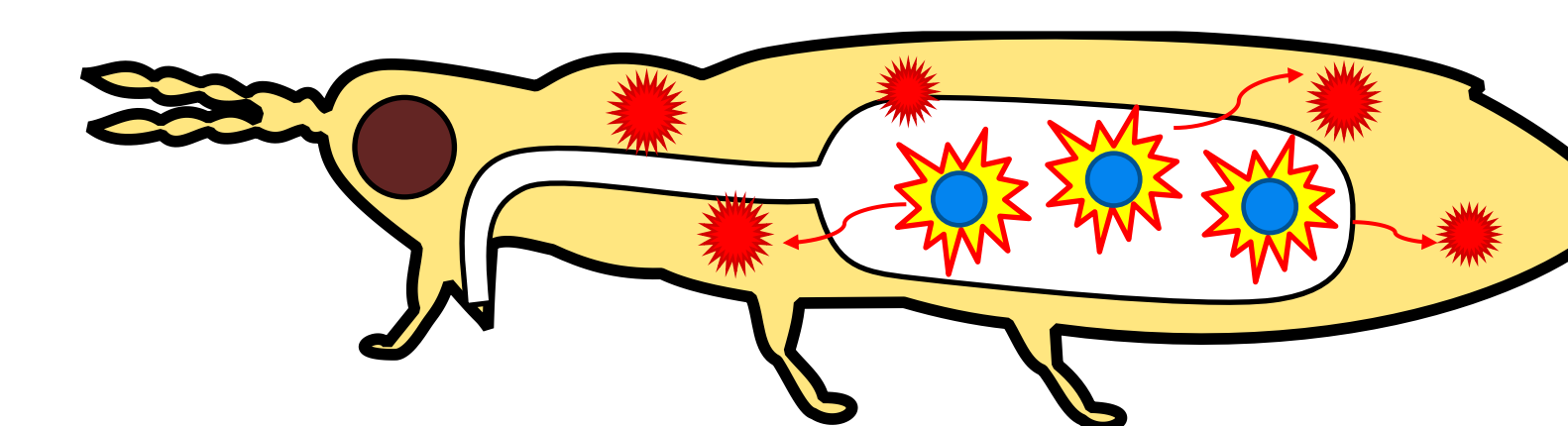
2 Insects ingest treated plant



3 PS activated by visible light (sunlight or LED light)



4 Reactive oxygen species are produced



5 Multi-targeted damage leading to insect death

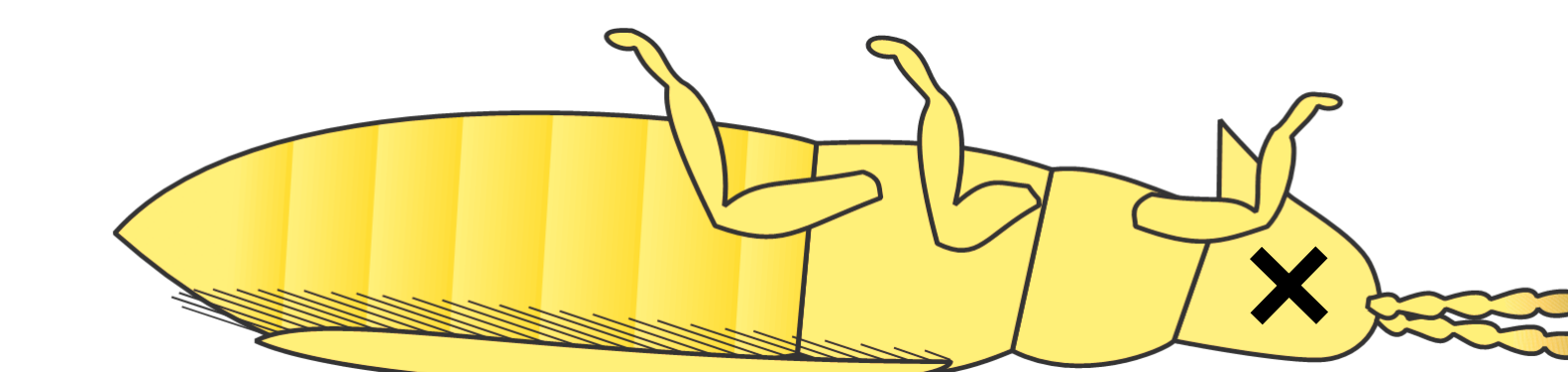


Figure 1. Photosensitizers are activated by visible wavelengths of light, produce reactive oxygen species and cause cell damage leading to insect mortality.

Research initiative

This collaborative project between Suncor Energy Inc. and Vineland Research and Innovation Centre will evaluate Suncor AgroScience's novel PS formulations as contact insecticides, as well as when ingested by common greenhouse pests.

Preliminary results, comparing the efficacy of photosensitizers and registered chemical insecticide against western flower thrips (WFT), *Frankliniella occidentalis*, indicate that PS show great promise for control (Fig 2). There is a clear indication that PS are inactive in low light conditions and are activated in suitable light conditions causing increased mortality in WFT (note the orange bars in Fig 2). PS in oil killed as many or more WFT as commercially used chemical insecticide (note the striped bars in Fig 2).

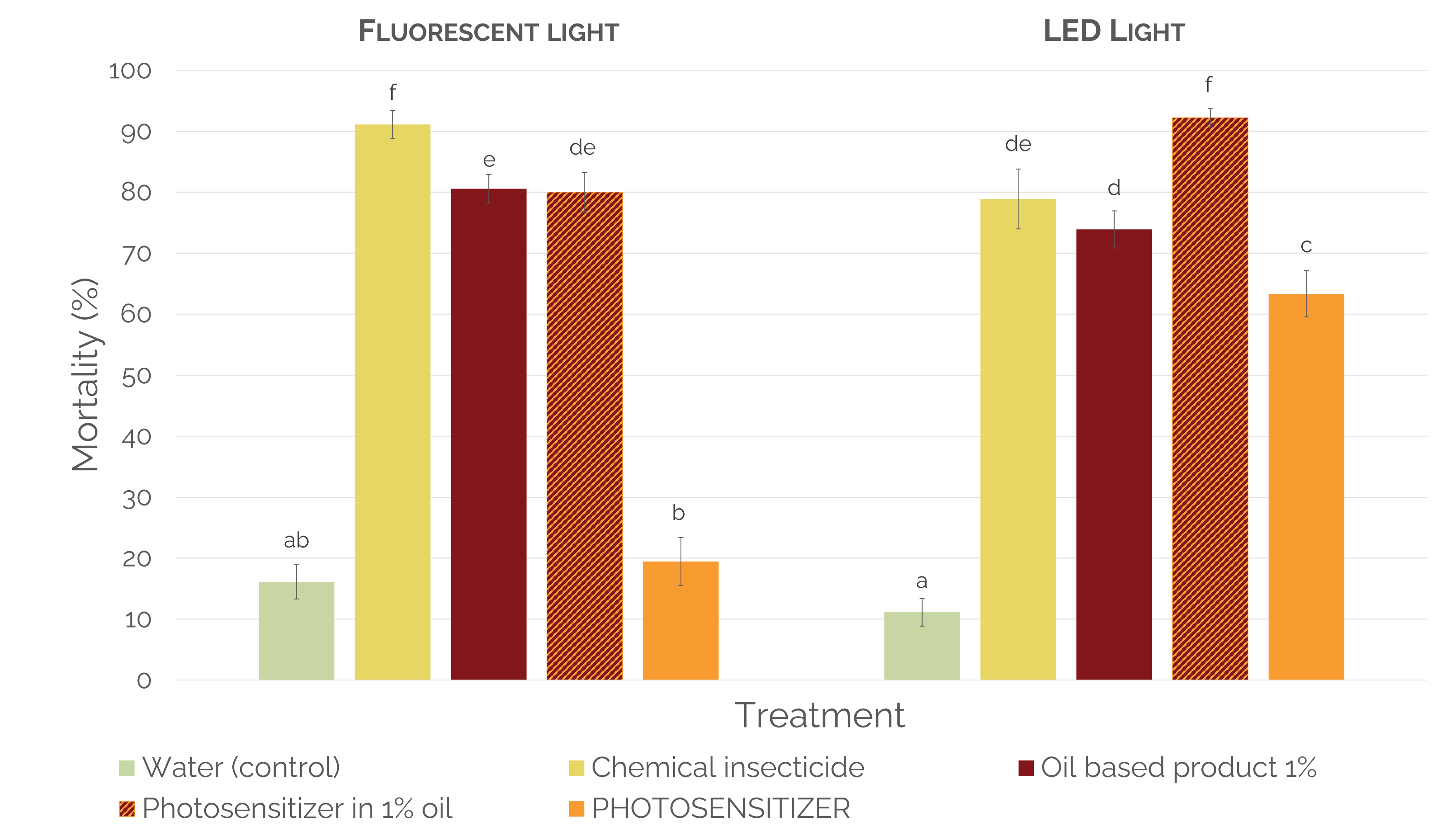


Figure 2. Mean percentage mortality of western flower thrips, two days after being treated and placed in fluorescent or LED light in a 12L:12D photoperiod. Means with the same letter are not significantly different from each other.

Acknowledgements

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