**RRES Press Release 22 April 2024 The optics of pest insect invasions**

***Light based sensors could provide early warning of pollen beetle infestation in oilseed rape***

Hi-tech optical sensors in fields could provide an effective means of monitoring beetle numbers arriving in oilseed rape (OSR) fields, according to a new study.

Results from an optically sensed field were compared to those baited with standard water traps and in-field counting by hand. The optical sensors recorded an increase in pollen beetles 2 days ahead of water traps and 4 days ahead of plant counts. In terms of early detection and numbers of beetles recorded, this was clearly the most efficient pollen beetle monitoring method.

“Understanding the dynamics of pest immigration into a crop field helps us find effective and timely management strategies,” said [Professor Emily Bick of the University of Wisconsin-Madison](https://www.rothamsted.ac.uk/news/www.bicklab.com) who led the study, alongside scientists from Rothamsted Research, [FaunaPhotonics A/S](https://faunaphotonics.com/) and the University of Copenhagen. “The pollen beetle is a significant pest of oilseed rape during budding stge. Many farmers in western Europe are now abandoning OSR as a crop because damage is so severe from pollen beetles, additional insect pests, and reduced availability of approved synthetic insecticides. Better surveillance of in-field pests could help us identify a way round the problem.”

Automated near-infrared optical sensors recorded the signal of light backscattered by insects flying through a detector beam. Researchers were able to record insects actually in flight and detect each insect’s wing beat frequency, which often differs from species to species. For instance, pollen beetles have a wing beat frequency of 120 Hz, so insects within the range of 100–140 Hz were considered pollen beetles. Sensors were run continuously in fields in Denmark, alongside parallel experiments on the spatial distribution of pollen beetles in oilseed rape crops at Rothamsted (UK).

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In all fields in the study, pollen beetles were found in significant numbers and were shown to aggregate; beetle density was related to plant growth stage, with more beetles occurring on plants after the budding stage than before inflorescence development.

“Our study suggests potential for precision agriculture to reduce insecticide use through targeting of pollen beetle aggregations - in other words treating only areas of the crop where pollen beetle density is high,” said Rothamsted’s Dr Sam Cook who is the senior author of the study. “Optical sensing of pollen beetles gives us more efficient monitoring in both time and space, so it is a promising tool for early warning of insect pest immigration. The aggregation pattern of pollen beetles post immigration could be used to precisely target control measures in oilseed rape crops.”

Sam Cook (L) and Emily Bick with the optical sensor

The aggregation of pollen beetles usually occurs first on the downwind edge of field and then expands to the centre. Early detection via sampling and monitoring should correspond with this migration pattern, allowing for more effective control.

A network of these or similar sensors at a crop or landscape scale could serve as the basis of a pest map, said Dr. Cook.

“A system that links the number of sensed insects immigrating into a field, the temperature, and the crop growth stage would better predict the risk of economic damage and provide an avenue for fully automated pest monitoring. Sensors might even be useful for tracking natural enemies to determine if an insecticide application is necessary considering biocontrol potential. Alternatively, pollinators may be identified in the field to avoid non-target insecticide effects on these beneficials, thereby contributing to both pesticide reduction and biodiversity protection goals for sustainable agriculture.”

Publication

Bick, E., Sigsgaard, L., Torrance, M.T., Helmreich, S., Still, L., Beck, B., El Rashid, R., Lemmich, J., Nikolajsen, T. and Cook, S.M. (2024), Dynamics of pollen beetle (*Brassicogethes aeneus*) immigration and colonization of oilseed rape (*Brassica napus*) in Europe. Pest Manag Sci, 80: 2306-2313. <https://doi.org/10.1002/ps.7538>