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Rothamsted Research comments on the recent study by Hixson et al. 2016 demonstrating that long-chain omega-3 polyunsaturated fatty acids have developmental effects on the crop pest, the cabbage white butterfly *Pieris rapae*

Rothamsted Research and Professor Johnathan Napier outline below the relevance of the Hixson *et al.* 2016 study findings to the Institute's field trial with genetically modified (GM) Camelina plants that have been engineered to produce omega-3 long-chain polyunsaturated fatty acids (omega-3 LC-PUFAs) in the seeds of the plants (http://www.rothamsted.ac.uk/camelina)

Context

Rothamsted Research scientists, who are strategically funded by the BBSRC, have developed genetically modified (GM) Camelina plants that produce in their seeds eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). The primary producers of EPA and DHA are marine algae. The researchers have been working towards developing terrestrial sources of omega-3 LC-PUFAs EPA and DHA that could provide an alternative source of these health beneficial fatty acids for the growing fish farming industry.

Hixson et al. 2016[1] carried out a study aiming to identify potential effects of the consumption of EPA and DHA by insect pests, such as cabbage white butterfly *Pieris rapae* that in their native environment, do not consume EPA and DHA when feeding. Hixson *et al.* 2016 concluded that: *"the presence of EPA and DHA in diets of larval P. rapae may alter adult mass and wing morphology; therefore further research on the environmental impacts of EPA and DHA production on terrestrial biota is advisable."*

Rothamsted Research is very interested in and takes into serious consideration the findings of the Hixson *et al.* 2016[1] study.

Key points:

- In Hixson *et al.* 2016 cabbage white butterfly larvae, which in their native environment feed on leaf tissue, were fed in *laboratory* conditions with *experimental* diets.

- In Hixson *et al.* 2016 the artificial diets were provided to the larvae as a formulation; EPA and DHA were isolated from algae directly and added in the artificial feed. By contrast the EPA and DHA synthesised by the GM Camelina plants are a component of the oil synthesised by the plant in the seed.

- The cabbage white butterfly in their native environment feed on leaf tissue. By contrast, and as noted also by Hixson *et al.* 2016, the genetically modified Camelina plants, that will be tested for their performance in the field at Rothamsted Research, have been engineered to produce omega-3 LC-PUFAs only in the seed of the crop. Cabbage white butterflies do not feed on seeds in their native environment.

- Rothamsted Research scientists have analysed leaf tissue of GM Camelina and non-GM Camelina plants to examine whether there is any production of EPA and DHA in the leaves of the plants, even if they have not been designed to do so. Rothamsted Research has unpublished data that demonstrate that the leaves of GM Camelina plants have exactly the

same fatty acid profile as non-GM camelina plants and are devoid of EPA and DHA. These data will be submitted for peer review as part of a broader study in the near future.

- Hixson *et al.* 2016 recognise that their preliminary study and supplement based experimental approach provides some initial findings that require further validation by testing in the laboratory and in the field insects feeding on actual plant tissues.

- Rothamsted Research scientists have discussed with Hixson et al. 2016 the development of collaborative projects to design research experiments to address the above questions.

Rothamsted Research and Professor Johnathan Napier welcome questions and enquiries from anyone interested in the Institute's omega-3 LC-PUFAs project and the GM field trial.

1. Hixson S.M., Shukla K., Campbell L.G., Hallett R.H., Smith S.M, Packer L., Arts M.T. (2016). Long-Chain Omega-3 Polyunsaturated Fatty Acids Have Developmental Effects on the Crop Pest, the Cabbage White Butterfly *Pieris rapae*. *PLoS One* 2016 Mar 24; **11 (3):** e0152264 doi: 10.1371/journal.pone.0152264. eCollection 2016