

The modes of action of *Mentha arvensis* essential oil on the granary weevil *Sitophilus granarius* revealed by a label-free quantitative proteomic analysis

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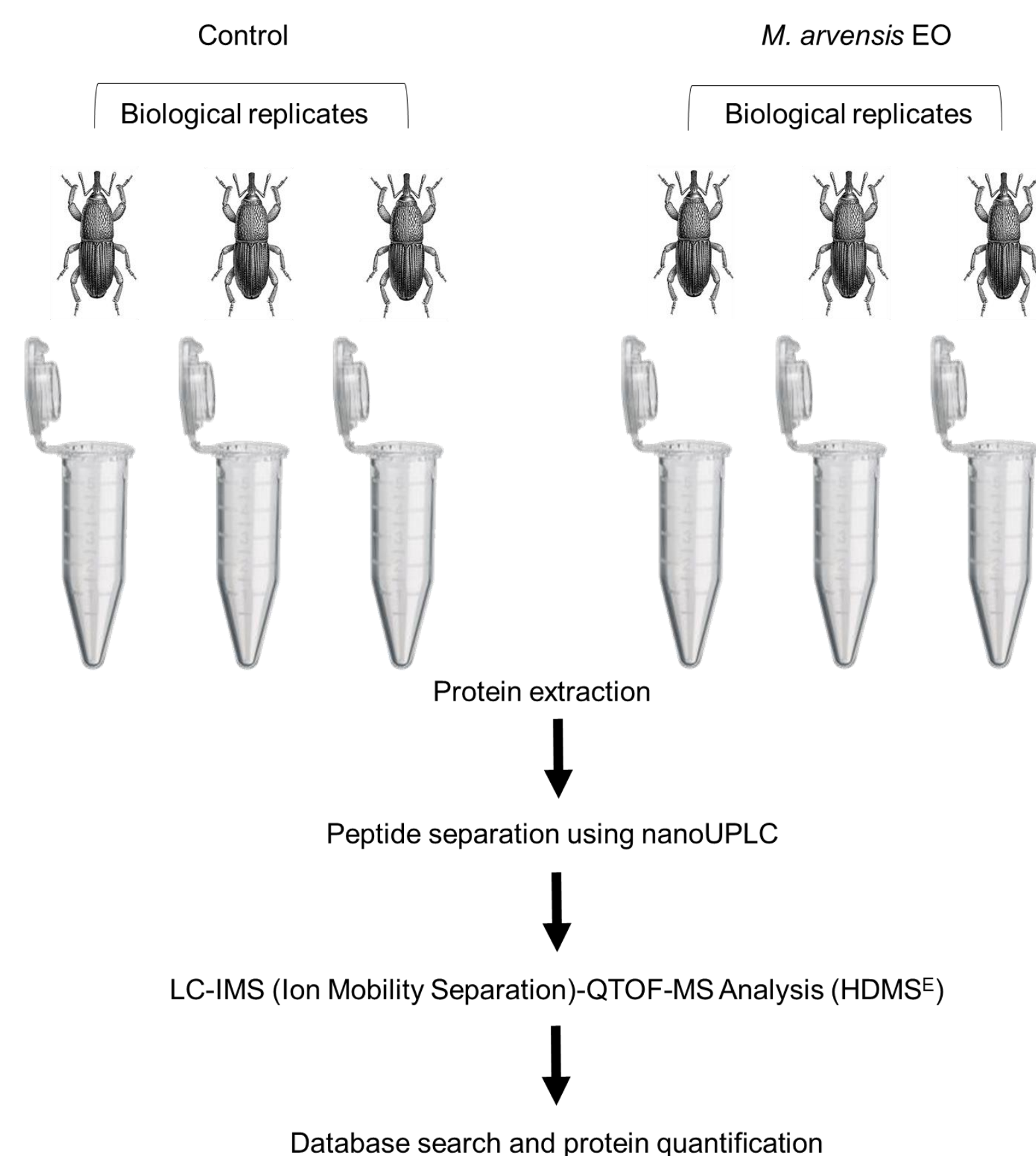
BIOLOGICAL CONTEXT

Although synthetic pesticides are still used to control insect pests, greater efforts have been made to develop healthier and more environmentally friendly pesticides¹. Due to their insecticidal properties, botanical essential oils (EOs) are considered as promising alternatives to the use of synthetic insecticides^{2,3}. However, little is known about the mechanisms underlying the insecticidal activity of most these natural compounds. Previous research has reported the insecticidal properties of EOs from plant species of the genus *Mentha*^{4,5,6}. In this study, we 1) evaluated the contact toxicity of *Mentha arvensis* EO against the granary weevil *S. granarius*, a major pest of stored grain in temperate regions and then used a label-free quantitative proteomics approach to decipher the modes of action of *M. arvensis* EO on *S. granarius*.

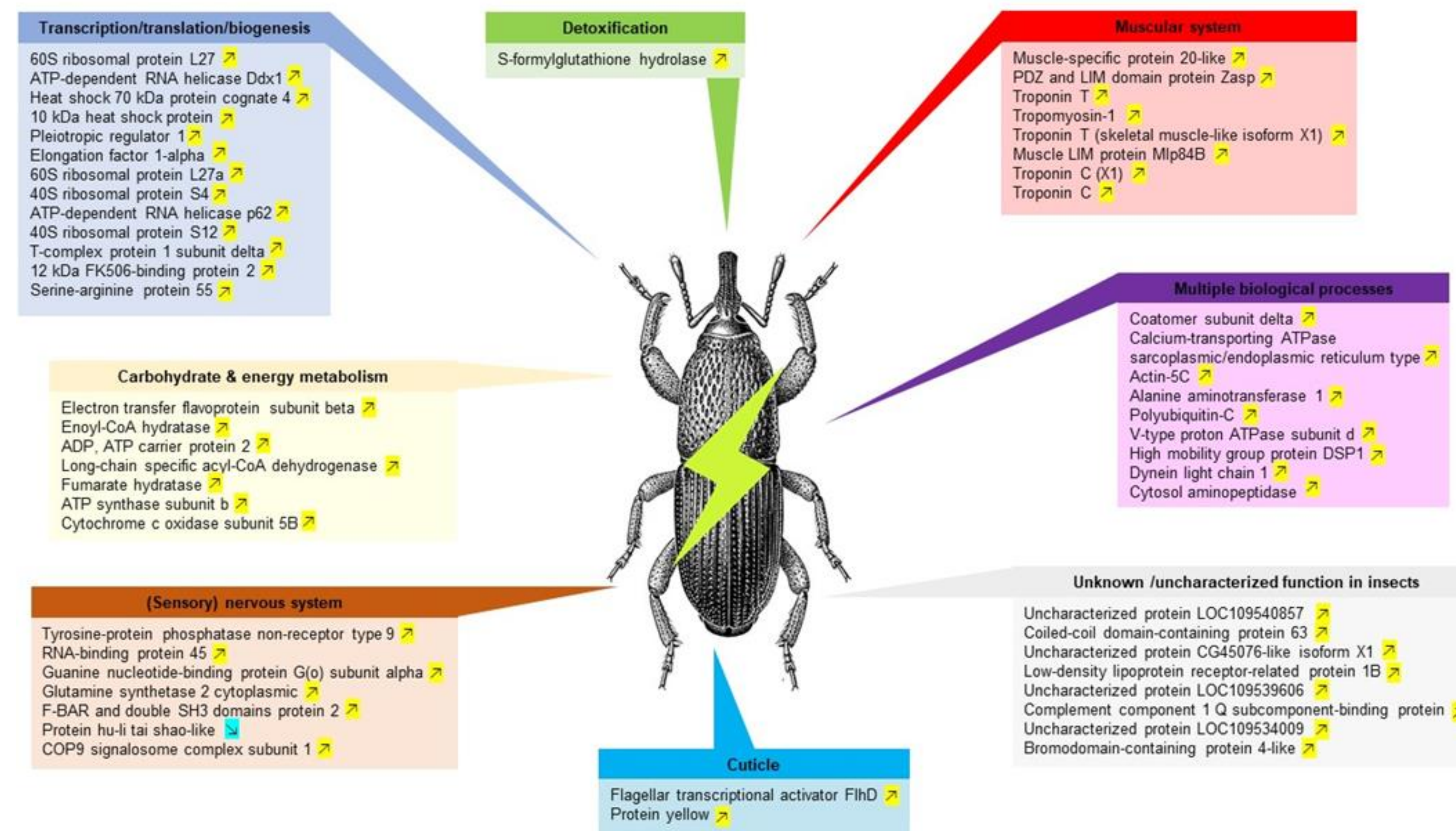
MATERIALS AND METHODS

- LD₅₀ of *M. arvensis* EO for *S. granarius* adults 24h post-treatment: 55.6 µg/insect.

- Label-free quantitative proteomic analysis:



RESULTS



DISCUSSION

- M. arvensis* EO induced dramatic physiological changes in *S. granarius* adults;
- DEPs were mostly upregulated and reflect the physiological state of the surviving insects;
- M. arvensis* EO is capable to affect a variety of biological processes in *S. granarius*;
- Our results shed light on the repair mechanisms put in place in surviving insects to deal with the damage inflicted;
- Conclusion:** this work highlights the modes of action of a promising EO to control pest of stored cereals and is a first step in the development of novel bio-rational insecticides.

1. Handford et al. (2015). Integrated environmental assessment and management, 11(4), 525-536. 2. Isman, M. B., & Grieneisen, M. L. (2014). Trends in plant science, 19(3), 140-145. 3. Pavela, R., & Benelli, G. (2016). Trends in plant science, 21(12), 1000-1007. 4. Tripathi, A. K. et al. (2000). *Journal of Medicinal and Aromatic Plant Sciences*, 22(1B), 549-556. 5. Aggarwal, K. K., et al. (2001). Toxicity of L-menthol and its derivatives against four storage insects. *International Journal of Tropical Insect Science*, 21(3), 229-235. 6. Mishra, B. B., et al. (2012). *Biological agriculture & horticulture*, 28(1), 34-40. 5.