

MOLECULAR BIOLOGY LABORATORY

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Section: -
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1. Staff:

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2. Brief description of the Lab:

Our lab is investigating two major research axes. The first axis concerns questions of molecular entomology, and more specifically the molecular mechanisms that induce the development of insecticide resistance, as well as the development and application of insect cell-based protein expression systems. The second axis, following the legacy of Prof. Hatziloukas, concerns mostly questions of molecular microbiology, and more specifically the study and molecular characterization of mycoviruses of phytopathogenic fungi as well as the genetic modification of bacterial strains and mutagenesis of genes for biotechnological applications.

The educational activities of the lab include the teaching and support of lab courses for the lessons "Molecular Biology", "Genetic Engineering" and "Evolutionary Biology" of the Department of Biological Applications and Technology, as well as teaching courses for Interdepartmental M.Sc. courses at the University of Ioannina.

3. Research activities:

- CRISPR/Cas9 genome modification in *Drosophila melanogaster* fruit fly for the characterization of candidate target-site resistance mutations for several insecticide classes.
- Genetic modification of *Drosophila melanogaster* for the expression and characterization of detoxification genes (cytochrome P450 monooxygenases)
- Expression of detoxification genes in baculovirus and stably transformed insect cell lines.
- Molecular analysis of phytopathogenic fungi mycoviruses
- Molecular taxonomy of varieties of the mastic tree of Chios

- Genetic modification of bacterial strains of interest to cheesemaking, towards the enhancement of their productivity
- Isolation and molecular analysis of lipase genes and mutagenesis towards generation of more productive enzymes in esterification reactions.

4. Laboratory infrastructure:

Basic infrastructure for Molecular Biology Lab.

Infrastructure for *Drosophila* culture and insect cell culture (under construction)

5. Services:

The lab provides services to third parties.

6. Research projects (titles):

- Investigating insecticide resistance via genetic transformation and genome modification in *Drosophila*. (Fondation Santé, 2020-2021)
- Agroindustrial Liquid and Solid Wastes as Raw Materials for the Production of a New Generation Biofuel.
- Cellulose Nano and Micro-Biotechnology: Applications in Food Industries.
- Improvement of mastic-tree productivity via utilization of selected clones with new technologies.

7. Indicative publications:

- **Douris, V.**, Steinbach, D., Panteleri, R., Livadaras, I., Pickett, J.A., Van Leeuwen, T., Nauen, R., Vontas, J. (2016) Resistance mutation conserved between insects and mites unravels the benzoylurea insecticide mode of action on chitin biosynthesis. *Proceedings of the National Academy of Sciences U.S.A.* **113**(51): 14692–14697.
- Parapouli, M., Foukis, A., Stergiou, P., Koukouritaki, M., Magklaras, P., Gkini, O.A., Papamichael, E.M., Afendra, A.S., **Hatziloukas E.** (2018). Molecular, biochemical and kinetic analysis of a novel, thermostable lipase (LipSm) from *Stenotrophomonas maltophilia* Psi-1, the first member of a new bacterial lipase family (XVIII). *Journal of Biological Research* **25**: (4).
- Kostas, S., **Hatziloukas, E.**, Hatzilazarou, S., Economou, A.S. (2019). Efficient vegetative propagation of various clones of mastic tree (*Pistacia lentiscus* 'Chia') through rooting of shoot cuttings. *Acta Horticulturae* **1242**: 735-742.
- Ingham, V.A., Anthousi, A., **Douris, V.**, Harding, N.J., Lycett, G., Morris, M., Vontas, J., Ranson, H. (2020) A sensory appendage protein protects malaria vectors from pyrethroids. *Nature* **577**: 376–380.
- Samantsidis, G.R., Panteleri, R., Denecke, S., Kounadi, S., Christou, I.K., Nauen, R., **Douris, V.**, Vontas, J. (2020) "What I cannot create, I do not understand": functionally validated synergism of metabolic and target site insecticide resistance. *Proceedings of the Royal Society B – Biological Sciences* **287**(1927): 20200838.
- **Douris, V.**, Denecke, S., Van Leeuwen, T., Nauen, R., Bass, C., Vontas, J. (2020) Using CRISPR/Cas9 genome modification to understand the genetic basis of insecticide resistance: *Drosophila* and beyond. *Pesticide Biochemistry and Physiology* **167**: 104595.
- Vorgia, E., Lamprousi, M., Denecke, S., Vogelsang, K., Geibel, S., Vontas, J., **Douris, V.** (2021) Functional characterization and transcriptomic profiling of a spheroid-forming midgut cell line from *Helicoverpa zea* (Lepidoptera: Noctuidae) *Insect Biochemistry and Molecular Biology* **128**: 103510.