Institute of Environmental Sciences

**Topic:** The diversity and dynamics of insect microbiomes

**Name of supervisor:** Dr. Piotr Łukasik (Prof. dr hab. Wiesław Babik)
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**Background information (max 200 words):**
Insects frequently associate with microbes, forming different types of symbiotic associations that often play major roles in the insect biology. We know that the microbiome abundance, composition and roles vary among insect species, but they also differ among populations, sampling dates, and among individuals sampled from a population at the same time. However, our understanding of the microbiome diversity patterns across insects, and factors that influence them, remains very limited.
The goal of the proposed project is a broad, comprehensive survey of microbial symbioses across the diversity of Swedish insects. We will do this in close collaboration with Insect Biome Atlas (IBA), a project currently sampling flying insect communities at hundreds of sites. We will use large numbers of insects carefully selected from that collection for the microbiome characterization using high-throughput next-generation sequencing. This approach will allow us to understand the microbiome composition across the taxonomic diversity of insects, as well as to describe the seasonal changes, geographic variation, and the effects of environmental factors on microbiomes of selected, broadly distributed species.

**The main question to be addressed in the project:**
The Ph.D. Student will primarily focus on the study of the diversity of microbes across thousands of insect species, addressing the question of how the microbiomes vary across the insect phylogeny.

**Information on the methods/description of work:**
Initially, the student will work with Swedish partners on preparing and curating large numbers of insect specimens from their extensive collection for the microbiome characterization, while learning the relevant bioinformatic techniques. They will participate in high-throughput next-generation sequencing library preparation. However, their main task is going to be the bioinformatic analysis of large amounts of insect microbiome composition data. Later, depending on interests, they may participate in phylogenomics and comparative genomics characterization of some of broadly distributed microbial clades. The student will be encouraged to work closely with other team members and project collaborators, including Insect Biome Atlas consortium members in Sweden and Dr. Brandon Cooper at the University of Montana, U.S.A.

**Additional information (e.g Special requirements from the student):**
The student will be supported by a research stipend (36 months), starting at 3500 PLN per month and increasing during subsequent years. This stipend may be combined with the Ph.D. program scholarship. Because the stipend recipient will be selected in a separate competition, the applicants interested in this project are asked to contact Dr. Piotr Lukasik (p.lukasik@gmail.com) directly, as soon as possible.
The successful candidate will have a demonstrated interest in Evolution, Entomology, Microbiology, and/or Genomics; experience with, or a keen interest in learning, Bioinformatics and Computational Biology; and strong English language, communication, and organizational skills. Previous experience with insect ecology, evolution, and especially symbioses, molecular biology, microbiome surveys, phylogenomics and/or comparative genomics, as well as willingness to travel are advantageous.
For more information on the project and the research group please check [www.symbioses.pl](http://www.symbioses.pl).

**Place/name of potential foreign collaborator:**
Fredrik Ronquist, Swedish Museum of Natural History
Brandon Cooper, University of Montana, U.S.A.

**References:**
Moran N.A., McCutcheon J.P. & Nakabachi A. (2008): Genomics and evolution of heritable bacterial symbionts. Annual Review of Genetics 42:165-190.
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Oliver K.M., Smith A.H., Russell J.A. (2014): Defensive symbiosis in the real world–advancing ecological studies of heritable, protective bacteria in aphids and beyond.
Functional Ecology 28(2): 341-355. <https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2435.12133>
Turelli M., Cooper B.S., Richardson K.M., et al. (2018): Rapid global spread of wRi-like Wolbachia across multiple Drosophila. Current Biology 28:963-971. <https://www.sciencedirect.com/science/article/pii/S0960982218301696>