**Penn State Entomology Funded Research Activities - October 2017**

Penn State has been successful in securing funding for several research activities related to the mushroom phorid fly, *Megaselia halterata*. We are in the process of recruiting post doctoral research scholars to undertake this research, and in the meantime, we are continuing with our research efforts related to fly trapping and monitoring in collaboration with the Harrogate community.

An overview of each of our funded research projects is provided below:

- **Giorgi Mushroom Endowment** funding is provided to the University to support small, 1-year, research initiatives related to the mushroom industry. Projects are submitted annually and selected on the basis of scientific merit and potential benefits to the mushroom industry.

**2016/2017** The entomology department received funding to support basic research to improve our understanding of phorid fly populations inside mushroom growing rooms, both within a single crop cycle, and over multiple crop cycles over a 12-month period. Phorid fly population data were collected from 15 different mushroom farms using sticky trap monitors. All participating farms volunteered to collaborate, and assisted the research program by collecting and changing the sticky cards in a single growing room every Monday, Wednesday and Friday for the entire 12-month study period (1 August 2016 to 31 July 2017). Cards were collected and counted at Penn State. These data are still being analyzed. We hope that these will provide essential information on how different management systems influence phorid fly numbers, and identify if there are any common factors that may influence the incidence of phorids on mushroom farms. Additionally, these data will enable us to better understand fluctuations in phorid population levels and may assist in providing a predictive model to assist mushroom farmers in making management decisions regarding early termination of a crop where large numbers of phorids are predicted to emerge prior to third break.

**2017/2018** Funding was obtained to support monitoring of phorid fly populations and movement inside a typical mushroom house (with multiple growing rooms at different crop stages) and around the exterior of the farm and in the Harrogate neighborhood. We also hope to develop 'mark release recapture' techniques, to enable us to monitor and define fly movement between growing rooms within the farm, and movement patterns around the farm and neighboring properties. All outdoor monitoring will be conducted using the same yellow sticky cards. Cards have been purchased by the project and supplied to the Harrogate community, who coordinate their fly collection data with the Penn State monitoring. Harrogate has developed their own schedule for placement of sticky traps, but also collect daily card data one week in each month, which is coordinated with fly trapping conducted by Penn State at a neighboring mushroom farm. We anticipate that these data will provide much needed information on phorid fly activity throughout the season.

- **Pennsylvania Department of Agriculture (PDA)**, funding was obtained to continue work on the isolation and identification of a sex pheromone or other attractants that could be used to attract and trap phorid flies. This project will also includes ecological studies to determine alternative habitats of phorid flies in the surroundings of the mushroom farms in Chester County. Some progress has been made, but activities will be picked up

by a post-doctoral research scholar who will start at Penn State in November.

- **National Institute of Food and Agriculture – Organic Agriculture Research and Extension Initiative** – '*Collaborative Research and Extension Network Addressing Challenges for Sustainable Organic Mushroom Production'*
  The Department of Entomology is contributing to this new (September, 2017) 4-year project focused on organic mushroom production. Activities will include evaluation of OMRI certified biopesticide formulations and macrobials for control of mushroom phorid and sciarid flies and their integration into organic production processes. We will address the current lack of available, effective pesticides by screening a range of low- risk, OMRI listed pesticide and biological control products, currently registered for use in other crop systems. Products demonstrating efficacy in laboratory assays will be evaluated for efficacy under semi field conditions and screened for phytotoxicity to the mushroom crop. Regulatory approval for label extension for use in mushroom crops will be sought in collaboration with the pesticide registrants of all promising products emerging from the screening program.
  Work will also continue to identify and develop semiochemical cues attractive to *Megaselia halterata* and *Lycoriella mali* that can be used to monitor and help mitigate fly populations to reduce their ability to drive pathogen epidemics.
- **USDA Crop Protection and Pest Management** - '*Development of eaves tubes as a new pest management tactic for IPM of mushroom flies' (October 2017)*

There are no chemical adulticides currently approved for use in mushroom production, and growers have no method for bringing *M. halterata* under control. This project will investigate the potential for implementation of novel 'eaves tubes' technology, initially developed for mosquito control, using insecticide impregnated eaves tubes, which contain insecticide treated electrostatic gauze, fitted to buildings to channel odor cues from inside a house. *M. halterata* behave very similarly to mosquitoes around mushroom houses. Growers already implement extensive exclusion strategies to try to reduce the movement of *M. halterata* in and out of the growing rooms. We will screen suitable commercial pesticide formulations for efficacy against mushroom flies in combination with electrostatic gauze. In order to determine the best placement of eaves tubes technology we aim to identify the key points of entry and exit for *M. halterata*, and their movement patterns within houses throughout the crop cycle. Successful implementation of eaves tubes technology will result in an effective, affordable and environmentally sound IPM strategy and reduction in economic, environmental, and societal losses from mushroom pests.