

Address for Correspondence: simon.tragust@uni-bayreuth.de

Many ant species are highly successful invaders and can dominate vast areas by forming dense networks of connected nests in contrast to the smaller and discrete, spatially dispersed colonies of most social insects. However, it was recently proposed that such supercolonies are more vulnerable to infection by parasites and diseases as they would serve as large targets with high rates of transmission from nest to nest. Here we studied the invasive garden ant *Lasius neglectus*, a new pest species which is currently spreading throughout Europe where several populations are infected with the ectoparasitic fungus *Laboulbenia formicarum*. In one population (supercolony) we followed the prevalence and intensity of the infection over 10 years, revealing an epizootic spread of the ectoparasite with the mean annual prevalence increasing from 0.126 to 0.997. Distinct body parts of the ants had markedly different infection intensities, and at low intensities antennae and thorax were free from signs of infection. There were no seasonal differences in infection intensity and no other *Lasius* species in the area was found to be infected. These results give the first direct support to the hypothesis that supercolonies of invasive ants potentially face a significantly higher threat from parasites and diseases compared to ants with normal colonies, implying interesting perspectives for biological control of these pest species.

Contributed paper. Tuesday, 12:00. **113**

**The dietary preference of a beneficial predator in apple orchards reveals an undocumented spore dispersal mechanism for entomopathogenic fungi.**

Anja Amtoft Wynns<sup>1</sup>; Annette Bruun Jensen<sup>1</sup>,  
Celeste d'Allesandro<sup>2</sup>, Jørgen Eilenberg<sup>1</sup>;

<sup>1</sup>Department of Plant and Environmental Sciences, University of Copenhagen, Frederiksberg, Denmark;

<sup>2</sup>Department of Entomology and Acarology, ESALQ, University of São Paulo, Av. Pádua Dias 11, C.P. 9 Piracicaba, São Paulo, CEP 13418-900, Brazil.

Address for Correspondence: aaw@life.ku.dk

In the course of a floristic and ecological study of the entomopathogenic fungi found in apple orchards and strawberry fields (part of the IMBICONT biological control project), we observed resting spores in the frass of the earwig *Forficula auricularia*, a beneficial predator in apple orchards. The presence of resting spores in earwig frass suggests that in addition to being a beneficial predator, earwigs may play a role in the dispersal of Entomophthoromycota—a spore dispersal mechanism not previously documented for this group of fungi. In the lab, we observed that earwigs avidly consumed entomophthoromycotan-infected insects even while the fungus was actively ejecting conidia. We hypothesize that this fungus-insect meal might confer a nutritional benefit but that earwigs avoid foraging on insects infected by generalist entomopathogenic fungi (e.g. *Metarhizium*, *Beauveria*) because these generalist entomopathogens pose a risk that would potentially outweigh any nutritional benefit. We present the preliminary results from a series of choice-experiments to test these hypotheses.

Contributed paper. Tuesday, 12:15. **114**

**Effects of entomopathogenic fungi on the “*Trialeurodes vaporariorum* – *Encarsia formosa*” system: preliminary results**

Monica Oreste, Eustachio Tarasco

Department of Soil, Plant and Food Sciences, Section of Entomology and Zoology, University of Bari “Aldo Moro”, Via

Amendola 165/a, 70126 Bari (Italy)

Address for Correspondence: eustachio.tarasco@uniba.it

The effects of a selected group of six entomopathogenic fungal isolates (including the mycoinsecticide Naturalis and the *Beauveria bassiana* ATCC74040 strain contained into the commercial product) on the system “*T.vaporariorum* - *E.formosa*” were evaluated, considering the direct effect on the parasitoid development but also on the *E. formosa* activity and behaviour. The effect of fungal treatments on the parasitoid development was evaluated submitting infested tomato plants to the fungal treatments at different times from the parasitization and recording the parasitization rate and the parasitoids emergence. Then, the effect of fungal isolates on *E. formosa* behaviour and activity was examined in “free-multiple-choice” and “no-choice condition”. Finally, the role of *E. formosa* in transmitting the mycoses from infected to uninfected host population was estimated. Results showed that fungal treatments can affect the *E. formosa* development, particularly when applied before the parasitoids introduction and using the mycoinsecticide Naturalis. *E. formosa* showed no differential tropism in “free - multiple-choice” conditions and it was not able to locate and select the uninfected hosts “at distance” but it was able to detect and avoid infected hosts by direct exploration. Furthermore, *E. formosa* was able in vectoring the fungal propagules from contaminated to uncontaminated hosts through its activity. Results of these laboratory experiments provided important information about the possibility to integrate the entomopathogenic fungal treatments and the *Encarsia formosa* releases and clarified some biological and behavioural aspects of the “host–pathogen–parasitoid” system.

## WEDNESDAY - 6 August

SYMPOSIUM 5 (Microbial Control) Wednesday, 8:00–10:00

### Developments/Issues in the Regulation of Microbial Products: Harmonization across Jurisdictions

Symposium. Wednesday, 8:00 **115**

**The authorisation and regulation of microbial biopesticides: why bother?**

David Chandler<sup>1</sup>, Liam Harvey & Wyn Grant<sup>2</sup>

<sup>1</sup>Warwick Crop Centre, School of Life Sciences, University of Warwick, Wellesbourne CV35 9EF UK, <sup>2</sup>Department of Politics and International Studies, University of Warwick, Coventry CV4 7AL, UK

Address for correspondence: dave.chandler@warwick.ac.uk

The use of microbial biopesticides and other minimal-risk products is starting to become more widespread as a result of new government legislation that aims to reduce the excessive use of conventional chemical pesticides and increase the use of “alternative” control methods. In the European Union, a paradigm shift in pesticide policy has occurred recently with the enactment of the Sustainable Use Directive on pesticides. This legislation makes IPM mandatory for farmers and growers and gives specific emphasis to biologically based controls including microbial biopesticides. There has been significant recent activity in the biopesticides industrial sector, with multinational agchem / agri-business companies buying up biopesticide

companies. The large financial resources of the global companies should lead to an increase in the effectiveness, sales and availability of microbial biopesticide products, but SMEs will still have a critical role to play through the development of innovative, "next generation" biopesticides. All of these products will need to have authorization for use by government regulatory organisation. Authorization can be slow and expensive, which can be a barrier to product development. The authorities recognize this and have put in place measures designed to improve the system, sometimes with mixed results. We have explored why product authorization is necessary, and in this presentation we will discuss ways in which biopesticide regulation could be improved further.

Symposium. Wednesday, 8:24 **116**

**Registration of Biopesticides in the EU: a company perspective**

Philip Kessler,

Andermatt Biocontrol AG, Grossdietwil, Switzerland  
Address for Correspondence: kessler@biocontrol.ch

One characteristic of many biopesticides is their narrow host range. This represents a lot of advantages, e.g. protecting the beneficial fauna, harmlessness towards human health etc., but it significantly reduces the potential market size for such products. The procedures for the registration of a biopesticide are mostly the same as for a chemical plant protection product, even if the characteristics of the active substance and the exigencies for the risk assessment differ in many aspects. The difficulties with registering biopesticides are often unknown or inappropriate data requirements, lack of experience within authorities to assess biopesticides, often resulting in unreasonable delays of the evaluation procedures, and too high registration fees. Under such conditions it is almost impossible for the industry to make the development of biopesticides with small-sized markets cost-effective. Furthermore they jeopardize investments in research for new biopesticides. Although the new EU regulation 1107/2009 provides new criteria for the approval of plant protection products - stricter evaluation timelines, a low risk category and evaluation within distinct zones- the uncertainties and high costs for the registration of biopesticides still exist. As a consequence, the industry will focus its investments in research and development of new biopesticides outside of the EU, where the registration of biopesticides is easier. It will become more difficult for European growers to have access to new, innovative and environmental friendly biopesticides in the future, especially in niche markets.

Symposium. Wednesday, 8:48 **117**

**Biopesticide registration, a company perspective and how registration influences biopesticide R&D approach of companies in North American**

Jarrod Leland

Novozymes Biologicals, Inc., 5400 Corporate Circle, Salem VA  
24153 United States, Phone: +1 540 302-1225  
Address for Correspondence: jrll@novozymes.com

When developing a new bioinsecticide active and associated formulations there are a series of stage gates that must be met by R&D to ensure final product registration in North America. At each gate confidence is gained to justify further resourcing. This presentation will discuss in general terms the critical milestones and strategy for prioritizing those milestones for a bioinsecticide. Specific reference will be made to Met52 and R&D's role in generating knowledge for its current registration and label expansion. By presenting this perspective, it may shed light on

the long path from discovering a promising isolate to making it a tool for growers. This may also help improve the dialogue between industry and academia to identify points along this path where collaborations can contribute towards that common goal.

Symposium. Wednesday, 9:12 **118**

**Registration of biopesticides: how research can be structured to suit microbial registration needs and promote the commercial development of new biopesticides**

Roma Gwynn

Biorationale Limited, Duns, UK  
Address for Correspondence: rgwynn@biorationale.co.uk

Invertebrate pathology is an applied field, and a major aim of research is to make the technologies discovered available to growers through the development and registration of new biopesticide products. The biopesticide market is growing at over 15% per annum: the global market was valued at \$1.3 billion in 2011 and is predicted to reach \$3.2 billion by 2017. There is a challenge therefore to meet the forecast demand for biopesticide products. Most of the micro-organism based products currently on the market are the 'back catalogue', representing research and technology that has been on the laboratory bench for the last 20 or 30 years. To bring plant protection products to the market they have to be registered, how this happens varies country to country and can take many years. In a biopesticide commercialisation pathway, registration is a significant barrier, demanding considerable investment in time and financial resources. Biopesticide research projects need to be designed and structured so research and industry can work in alignment and so reduce the hurdle of registration. This presentation will explore approaches that have been implemented in biopesticide projects to better align research and industry objectives and build partnerships to facilitate the regulatory process thus reducing commercialisation costs and reducing product development timelines.

Symposium. Wednesday, 9:36 **119**

**Current developments and issues on regulation of biopesticides- Lessons from REBECA project, comparison of EU and USA systems**

Sabine Asser-Kaiser, Jacqueline Süß, Rüdiger Hauschildd  
GAB Consulting GmbH, Heidelberg/Lamstedt, Germany

Address for Correspondence:  
sabine.asser-kaiser@gabconsulting.de

Microorganisms as active ingredients in plant protection products are gaining more and more importance. This is due to the fact that most of them have little effect (if any at all) on human health, non-target organisms, and the environment. However, registration of Microbial Plant Protection Products is still facing particular problems, which is partly due to the fact that some data requirements which can be easily covered for synthetic chemicals cannot be fulfilled for microorganisms and their products for technical reasons. On the other hand, the major advantage of most microbial products is that the microorganism species are scientifically well known and humans are familiar with them either through direct use or environmental exposure for a long time. Data requirements are similar in different regulatory systems, but acceptance of publicly available data for the risk assessment by authorities varies over time and between different regulatory systems.