

highlight data that are not routinely collected but could be and that would improve the quality of model predictions. I will also indicate where the development of in theory is currently hampered for want of appropriate data and to which invertebrate pathologists could make a valuable contribution.

Symposium. Tuesday, 8:24. 56

Factors affecting transmission of fungal pathogens of aphids

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In terms of biological control, fungal pathogens are the most important microbial agents for control of pest aphids. There are many species of fungi that attack aphids and epizootics are common. Much has been learned about the factors that affect transmission of aphid pathogens such as: aerial movement of conidia, relative humidity, sunlight, host density, resting spore biology, movement of infected alatae, behavior of infected aphids, and host range. In spite of these many questions remain and manipulating fungi to produce epizootics in aphids remains a difficult feat. Examples of what is currently known about fungal pathogens of *Aphis gossypii*, *Aphis glycines* and other species will be discussed, particularly the pathogen *Neozygites fresenii*.

Symposium. Tuesday, 8:48. 57

Consideration of vertically transmitted microsporidia for biological control

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Vertical transmission is common for pathogens of relatively low virulence because successful larval development, adult emergence, mating and reproduction of the infected host must occur after an infection is acquired, usually during the larval stages. Most microsporidia that are vertically transmitted are also horizontally transmitted, whether in a single host species or via an intermediate or alternate host. This would appear to favor the persistence of microsporidia released as classical biological control agents against their natural hosts. From a different perspective, successful transovarial transmission requires an explicit interaction between a pathogen and its host, and probably limits the ability of microsporidia to host switch. Laboratory studies of European corn borer, *Ostrinia nubilalis* larvae challenged by *Nosema* spp. and *Vairimorpha* spp. isolated from other stem-boring and row crop hosts showed that transmission, both horizontal and vertical, is a barrier to successful invasion of nontarget species. Vertical transmission is probably more stringent than horizontal transmission. Transmission experiments, therefore, may provide a more refined laboratory test of host specificity for microsporidia that are orally infective to nontarget hosts.

Symposium. Tuesday, 9:12. 58

Transmission of viruses to mosquito larvae mediated by divalent cations

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The most common occluded viruses of mosquitoes are baculoviruses (nucleopolyhedroviruses, NPV) and cypoviruses (CPV). Mosquito NPV's have a circular, double-stranded DNA genome packaged into rod-shaped enveloped capsids embedded in a protein matrix. Mosquito cypoviruses are RNA viruses with a 10 segmented genome packaged into an icosahedral virion. Replication, assembly and occlusion of CPV's occurs in the cytoplasm of midgut epithelial cells. Historically, both mosquito NPV's and CPV's have been difficult to transmit to the larval host. Studies on an NPV from *Culex nigripalpus* (CuniNPV) revealed that transmission is mediated by divalent cations: magnesium is essential, whereas the presence of calcium

inhibits the activity of magnesium. Transmission of a second baculovirus (UrsaNPV) is also enhanced by the presence of magnesium. Transmission studies with a CPV from *Uranotaenia sapphirina* (UsCPV) have shown a 30 fold increase in infectivity when magnesium is present. Calcium inhibits the activity of magnesium to facilitate transmission of UsCPV. The role these divalent ions play in either enhancing or inhibiting transmission is unknown. It is interesting that two distantly related virus groups have similar transmission requirements suggesting that the divalent ions interact with components of the mosquito midgut rather than directly with virions of the virus.

Symposium. Tuesday, 9:36. 59

Effect of mono- and poly-gyne social forms on transmission and spread of microsporidia in fire ant populations

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Thelohania solenopsae, a pathogen of red imported fire ants, *Solenopsis invicta*, can be transmitted by introducing infected brood into a colony. The social form of the ant, that is, monogyny (single queen per colony) or polygyny (multiple queens per colony) are associated with different behaviors, such as territoriality, that affect the degree of intercolony brood transfer. *T. solenopsae* was found only in polygynous colonies (83%) in Florida. Non-synchronous infections of queens and transovarial transmission favor the persistence and probability of detecting infections in polygynous colonies. However, queens or alates with the monogynous genotype can be infected and infections in monogynous field colonies of *S. invicta* have been reported from Louisiana and Argentina. Alate queens with the monogynous genotype have a greater dispersal capability than polygynous alates and could potentially facilitate the spread of the pathogen. Demise of infected monogynous colonies can be twice as fast as in polygynous colonies and favors the pathogen's persistence in polygynous fire ant populations. The social form of the fire ant reflects different physiological and behavioral aspects of the queen and colony that will impact *T. solenopsae* spread and ultimate usefulness for biological control.

SYMPOSIUM (Division of Fungi). Tuesday, 8:00-10:00.

Emerging genomics of fungal entomopathogens

Symposium. Tuesday, 8:00. 60

Generation of a robust EST dataset for the entomopathogenic fungus *Beauveria bassiana*

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Beauveria (Cordyceps) bassiana is a broad host range entomopathogenic fungus under intensive study as an arthropod biocontrol agent. Strains of *B. bassiana* have been selected for directed virulence towards insects and other arthropods that act as agricultural pests, disease vectors, ecologically hazardous, invasive pests, and even household nuisance pests. *B. bassiana* produces at least three distinct single cell propagules including aerial conidia, *in vitro* vegetative cells termed blastospores, and microcyclic conidia that can be isolated from agar plates, rich broth liquid cultures, and under conditions of nutrient limitation in submerged cultures, respectively. cDNA libraries were constructed from each *B. bassiana* cell type and a robust expressed sequence tagged (EST) dataset was generated. Additional cDNA libraries from cells sporulating on chitin and producing the secondary metabolite oosporein also contributed to yield a diverse array of transcripts. Approximately 2,000 clones from each library were sequenced and a unique sequence set was constructed. Comparative analysis of the expressed transcripts in each library indicated significant differences in gene expression pattern between the cell types in several broad categories including cell wall biosynthesis, secondary metabolism, and the production of proteases.