Volume 116, January 2018

ISSN 1049-9644

ELSEVIER

Biological Control

Theory and Application in Pest Management

Special Issue:
When insect endosymbionts and plant endophytes mediate biological control outcomes
Guest Editors: J.P. Michaud, Judith K. Pell and Fernando E. Vega

Available online at www.sciencedirect.com

ScienceDirect

Biological Control

Theory and Application in Pest Management

Volume 116, January 2018

ELSEVIER

Amsterdam - Boston - London - New York - Oxford - Paris - Philadelphia - San Diego - St. Louis

Special Issue:

When insect endosymbionts and plant endophytes mediate biological control outcomes

Guest Editors:

J. P. Michaud, Judith K. Pell and Fernando E. Vega

Contents lists available at ScienceDirect

Biological Control

journal homepage: www.elsevier.com/locate/ybcon

Volume 116, January 2018

CONTENTS

Continued

Abstracted/indexed in EMBiology. Also covered in the abstract and citation database Scopus®. Full text available on ScienceDirect®.

1049-9644(201801)116:C;1-J

Biological Control 116 (2018) 1–2

Contents lists available at ScienceDirect

Biological Control

journal homepage: www.elsevier.com/locate/ybcon

Editorial

When insect endosymbionts and plant endophytes mediate biological control outcomes

The identification of endosymbionts and endophytes within insect and plant tissues, respectively, has increased exponentially over the past 10–15 years, enabled largely by the proliferation of sensitive molecular techniques and publicly accessible databases of nucleotide sequences. However, the rate of detection and identification has far outpaced our understanding of their ecological significance. Although ubiquitous in a wide range of taxa, their presence is usually facultative; they are neither essential to the survival of the host species, nor do they infect all individuals in a population. Endosymbionts and endophytes have been described as 'influential passengers' (O'Neill et al., 1997; Vega et al., 2010), perhaps hitchhikers, but not simply freeloaders. As living organisms, they require nutrition, so their infection comes at some cost to the host, a cost that is presumably balanced by some ability to contribute specific physiological or ecological functions that benefit the host under particular ecological conditions. In arthropods, these benefits may include increased thermal tolerance, expanded geographic range, expanded host/diet range, enhanced immunity to pathogens, and protection against parasitism, although in many cases, putative benefits remain to be determined. Similarly, entomopathogenic fungal endophytes may reduce herbivory, serve as biocompetitors against plant pathogens, and increase plant growth (i.e., act as biofertilizers). Clearly, we are just beginning to understand how these organisms can mediate trophic relationships, alter the outcome of competitive interactions, and ultimately affect the very structure of arthropod and plant communities. Given these considerations, and recent developments that illuminate some novel roles for endosymbionts and endophytes in mediating biological control outcomes, we felt that the time was right for a special issue of *Biological Control* that would bring together authors working to understand the various roles of endosymbionts and endophytes in different ecological contexts.

Hopper et al. (this issue) explore the effects of *Hamiltonella defensa* infection on the fitness of two species of *Aphelinus* (Hymenoptera: Aphelinidae) developing in two aphid species. Otero-Bravo and Sabree (this issue) evaluate the utility of an obligate gamma-protobacterial mutualist as a proxy for measuring host diversity and distribution of the invasive brown marmorated stinkbug, a current target of biological control efforts in North America. Vorburger (this issue) reviews the potential challenges for biological control posed by defensive symbionts of aphids, the costs to aphids of harboring such symbionts, the evolution of counter-adaptations by parasitoids, and then suggests some practical approaches for managing their potentially disruptive effects in aphid biological control programs. Desneux et al. (this issue) use sampling, laboratory experiments, and published literature to test the hypothesis that invasive aphid populations harbor a lower diversity of endosymbionts than do native populations of the same species, and assess the rate at which *H. defensa* infection is lost from *Aphis craccivora* colonies in the absense of selective pressure from parasitoids.

A total of eight papers cover different aspects of fungal and bacterial endophytes. Jaber and Ownley (this issue) present a review of research aimed at elucidating the dual roles of entomopathogenic fungal endophytes as antagonists of insect pests and plant pathogens. Bromfield et al. (this issue) describe a model that researchers and regulators can use to identify and quantify the risks and benefits to be derived from endophytes and plants with novel traits; they present two case studies of the model in practice in New Zealand legislation under the Hazardous Substances and New Organisms (HSNO) Act. In manipulative experiments conducted in Jordan, Jaber and Araj (this issue) elucidated the differential effects of plants endophytically-colonised by entomopathogenic fungi on both herbivorous pests (aphids) and their natural enemies (parasitoids); aphids suffered prolonged development time, delayed onset of reproduction, and reduced birth rate on endophytically-colonised plants, while percentage mummification by parasitoids and the development time, sex ratio, adult emergence and adult longevity of their progeny were unaffected. A paper by Krell et al. (this issue) presents a novel aspect in the field of entomopathogenic fungal endophytes, involving the encapsulation of *Metarhizium brunneum* as a method to promote endophytism in tomato plants in Germany. Based on work done in Colombia, Parsa et al. (this issue) describe seed soaking as an effective method in introducing *Beauveria bassiana* or *Metarhizium anisopliae* as endophytes in the common bean (*Phaseolus vulgaris*) and reveal the high variability in results due to the use of non-sterile soils. Working in Germany, Rondot and Reineke (this issue) present evidence of reduced infestation of the vine mealybug (*Planococcus ficus*), a piercing-sucking insect, in grapevine (*Vitis vinifera*) endophytically colonised by *B. bassiana*. Sánchez-Rodríguez et al. (this issue) present results of research conducted in Spain involving endophytic *B. bassiana* increasing spike production in wheat and also controlling the cotton leafworm (*Spodoptera littoralis*). In a paper dealing with bacterial endophytes in New Zealand, Wicaksono et al. (this issue) report that endophytic bacteria isolated from the medicinal plant *Leptospermum scoparium* can effectively colonize kiwifruit (*Actinidia deliciosa*) and inhibit damage caused by bacterial canker of kiwifruit (*Pseudomonas syringae* pv. *actinidae*).

https://doi.org/10.1016/j.biocontrol.2017.11.003

Available online 06 November 2017
1049-9644/

References

Bromfield, K.E., Corin, S., Atapattu, A., 2017. A qualitative binary risk assessment model for regulating the biosecurity and environmental risk of endophytes. Biol. Control this issue.

Desneux, N., Asplen, M.K., Brady, C.M., Heimpel, G.E., Hopper, K.R., Luo, C., Monticelli, L., Oliver, K.M., White, J.A., 2017. Intraspecific variation in facultative symbiont infection among native and exotic pest populations: potential implications for biological control. Biol. Control this issue.

Hopper, K.R., Kuhn, K.L., Lanier, K., Rhoades, J.H., Oliver, K.M., White, J.A., Asplen, M.K., Heimpel, G.E., 2017. The defensive aphid symbiont *Hamiltonella defensa* affects host quality differently for *Aphelinus glycinis* versus *Aphelinus atriplicis*. Biol. Control this issue.

Jaber, L.R., Araj, S.-E., 2017. Interactions among endophytic fungal entomopathogens (Ascomycota: Hypocreales), the green peach aphid *Myzus persicae* Sulzer (Homoptera: Aphididae), and the aphid endoparasitoid *Aphidius colemani* Viereck (Hymenoptera: Braconidae). Biol. Control this issue.

Jaber, L.R., Ownley, B.H., 2017. Can we use entomopathogenic fungi as endophytes for dual biological control of insect pests and plant pathogens? Biol. Control this issue.

Krell, V., Jakobs-Schoenwandt, D., Vidal, S., Patel, A.V., 2017. Encapsulation of *Metarhizium brunneum* enhances endophytism in tomato plants. Biol. Control this issue.

O'Neill, S.L., Hoffmann, A.A., Werren, J.H., 1997. Influential Passengers: Inherited Microorganisms and Arthropod Reproduction. Oxford University Press, New York.

Otero-Bravo, A., Sabree, Z.L., 2017. Comparing the utility of host and primary endosymbiont loci for predicting global invasive insect genetic structuring and migration patterns. Biol. Control this issue.

Parsa, S., Ortiz, V., Gómez-Jiménez, M.I., Kramer, M., Vega, F.E., 2017. Root environment is a key determinant of fungal entomopathogen endophytism following seed treatment in the common bean, *Phaseolus vulgaris*. Biol. Control this issue.

Rondot, Y., Reineke, A., 2017. Endophytic *Beauveria bassiana* in grapevine *Vitis vinifera* (L.) reduces infestation with piercing-sucking insects. Biol. Control this issue.

Sánchez-Rodríguez, A., Raya-Díaz, S., Zamarreño, A.M., García-Mina, J.M., del Campillo, M.C., Quesada-Moraga, E., 2017. An endophytic *Beauveria bassiana* strain increases spike production in bread and durum wheat plants and effectively controls cotton leafworm (*Spodoptera littoralis*) larvae. Biol. Control this issue.

Vega, F.E., Simpkins, A., Aime, M.C., Posada, F., Peterson, S.W., Rehner, S.A., Infante, F., Castillo, A., Arnold, A.E., 2010. Fungal endophyte diversity in coffee plants from Colombia, Hawai'i Mexico and Puerto Rico. Fungal Ecol. 3, 122–138.

Vorburger, C., 2017. Symbiont-conferred resistance to parasitoids in aphids – challenges for biological control. Biol. Control this issue.

Wicaksono, W.A., Jones, E.E., Casonato, S., Monk, J., Ridgway, H.J., 2017. Biological control of *Pseudomonas syringae* pv. *actinidiae* (Psa), the causal agent of bacterial canker of kiwifruit, using endophytic bacteria recovered from a medicinal plant. Biol. Control this issue.

J.P. Michaud
Department of Entomology, Kansas State University, Agricultural Research Center – Hays, 1232 240th Ave., Hays, KS 67601, USA
E-mail address: jpmi@ksu.edu

Judith K. Pell
J.K. Pell Consulting, 74 Wardown Crescent, Luton, Bedfordshire, LU2 7JT, UK
E-mail address: JKPell1@gmail.com

Fernando E. Vega
Sustainable Perennial Crops Laboratory, United States Department of Agriculture, Agricultural Research Service, Beltsville, MD 20705, USA
E-mail address: Fernando.Vega@ars.usda.gov