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## Biorational Tree-Fruit Pest Management

Author: Stelinski, Lukasz

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In May of 2004, the field of entomology and more specifically the fields of ethology, behavioral ecology, evolutionary biology, and integrated pest management unexpectedly lost a pioneering and leading scientist and colleague, Ronald J. Prokopy (Papaj 2004). Summarizing Ron's influence on those fields with respect to both fundamental and applied scientific accomplishments is a daunting task and it is an absolute pleasure to read a book that simultaneously honors his legacy, provides a historical overview of his work, and summarizes the breadth of his work and that of his many students and collaborators. The book is partially the result of a symposium to honor Ron's life and work held at the 2005 national Entomological Society of America meeting in Fort Lauderdale, Florida. Stemming from that initial meeting, the editors of the book (who were also students and/or close colleagues of Ron) invited some of his collaborators to develop independent and largely non-overlapping chapters that highlight specific areas of research or practical application either led or conceived by Ron.

The book begins with a very insightful chapter focusing on the conceptual framework of IPM, which integrates historical perspectives and key ecological theory. The chapter is full of information useful to students and practitioners of pest management that is not found in 'traditional' IPM texts. This includes a thorough discussion of the 'levels of IPM', how arthropod community structure affects tree fruit IPM, and the ecological background that is needed for sound IPM theory (including arthropod colonization, guilds, and habitat stability). This first chapter is also chock full of key references (some of which are considered 'obscure' unfortunately as they should be prominent) as well as excellent 1-page figures that integrate vast amounts of information and could easily serve as pedagogical tools. The second chapter quickly switches gears to evolutionary biology and sympatric speciation, illustrating the breadth of Ron Prokopy's influence, ranging from highly applied pest management science to the fundamental principles of speciation. This second chapter is simultaneously written in a playful style—highlighting brief anecdotes about working with Ron that give the reader an inspiring glimpse into what it was like to work at his side—as well as in a well structured style that includes a thorough review of the *Rhagoletis* story encompassing natural history, behavior, chemical ecology, and evolutionary biology. The chapter is creatively written in the framework of "Ten lessons from Ron." This chapter alone makes this book a valuable contribution to our science; it should be read more than once, and I suspect that it should be broadly inspiring to students inter-

ested in evolution, entomology and related fields. The third chapter is equally inspiring, focusing on the "functional and behavioral ecology of tree fruit pests." Although the apple maggot, *Rhagoletis pomonella* (Walsh), is famously Ron Prokopy's white rat, his influence on behavioral ecology in general is unparalleled. This chapter brilliantly highlights the many fundamental discoveries authored by Ron and his co-workers on basic and applied ecology and illustrates how these shaped pest management. This chapter is also written creatively, the framework being the "four Fs of Life: feeding, fighting, fleeing and reproduction." This chapter is also full of excellent references spanning 7 decades of prodigious literature on the life history, behavior, and ecology of tephritids with key new references that make it highly useful to up and coming students. Chapter three also deserves more than one read by professional ecologists and pest managers and should inspire future students.

Chapters four and five focus on host finding mechanisms by tree fruit pests and monitoring/management of apple maggot and plum curculio, *Cunotachelus nenuphar* (Herbst), respectively. Both chapters are meant to honor Ron Prokopy's legacy and focus on both the type of detailed and elegantly simple behavioral research that Ron conducted and inspired as well as some of the insects that he dedicated much of his efforts to studying. Both chapters provide useful references and are expert reviews of current and more classic literature on their respective subjects. However, I found them much less inspiring than the initial three chapters. They are both written in a more traditional style, at times in the 'case study format,' and likely will be of interest to a much narrower audience than chapters 1-3 and others, particularly those interested in specific pests of temperate tree fruit. Yet, both of these chapters succeed in further underscoring Ron Prokopy's vast influence on pest management science.

Chapter six provides a wonderful history of the evolution of integrated pest management in the New England area with reflections on other tree fruit growing regions. This chapter synthesizes the history of how biorational and ecologically-based pest management practices came to be in this region of the United States and highlights Ron's involvement in the process, simultaneously illustrating that his commitment to the apple industry equaled his commitment to science. It is difficult to imagine that another source of this specific information, provided so thoroughly and insightfully, will ever exist in any other volume. Chapter seven focuses on pest management with environmental manipulation, heavily referencing the tephritid literature. This is again a more stan-

dard review chapter with information that can be found summarized in other venues. It is, however, useful in this volume as it provides many important current references and is an up-to-date compilation of recent research on this topic. Chapter eight is also a standard review chapter, but on plant disease management in tree fruit. This is refreshing as it further makes the book of broad interest beyond the often insect-centric literature on IPM. It reminds the reader that Ron's ecologically based pest management in his own apple orchard was holistic and not specific to the apple maggot. The final, ninth chapter of this book focuses on the implementation of integrated pest management and its actual usefulness to the consumer. This is a brilliant ending to this book and this information is sorely missing from many texts on pest management. It provides a historical perspective on the adoption of some of Ron's inventions, which he developed with a host of close colleagues and collaborators. The chapter highlights the need for an ecological pest management industry; the driving forces behind its existence, and its perils. It succinctly describes the sociological factors that drive the existence of this industry and those, which at times drag it down. Throughout, the chapter provides a wonderful historical perspective of Ron Prokopy's role and mentions that he (ever selfless) didn't even consider patenting the Red Sticky Trap!

In the preface, the editors state their hope that the book could serve as an instructional tool in IPM and related courses dealing with sustainable agriculture. Although the book fittingly focuses on pome fruit production, given its role as a tribute to Ron, I believe it could serve this purpose even in general IPM courses. With well conceived chapters on IPM theory; applications of behavior, ecology, and evolutionary theory to pest management; as well as historical perspectives on how ecologically (biologically) based management was conceived and is being implemented make this a valuable text for general courses on the topic. With respect to more senior readership, certain chapters may be more hit or miss, depending on the interest areas of the reader. The book is quite broad topically (again illustrating Ron Prokopy's broad legacy). Although some might find certain chapters indispensable, they may simultaneously find others not useful based on their own interests

and background. In the era of 'e-versions' of everything and electronic reprints, some readers may choose to carefully consider topic areas and request reprints of the chapters of their specific interest. I personally love thumbing through the hard copy version of a good book and find this one a very worthwhile addition to my collection. I highly recommend the book to all of my colleagues, whether they are interested in the most applied aspects of pest management to the most fundamental questions on animal behavior.

One concluding comment is about a slightly sad reality that is mentioned more than once in the book by different authors. This is the void left behind by Ron Prokopy's passing in the current atmosphere of university-based applied science. Obviously Ron could never be replaced and no one could fill his shoes, but the point is made (at least indirectly) that perhaps less and less opportunity exists in the current atmosphere for the next generation of young scientists to follow in his footsteps. The book wonderfully illustrates over and over how the deepest questions can be elegantly answered with 'simple' (hindsight) experiments and sometimes on a shoe-string budget. The question the reader is left with is: If positions like Ron's are not re-filled in the current climate and into future, what will happen to the field of 'biorational tree-fruit pest management'? In the era of endless budget cuts and the notion that every new position description title needs to be prefaced by the word 'molecular,' it leaves the reader wondering. I am hopeful this book will serve as a source of inspiration to the next generation of behaviorists, ecologists and applied agriculturalists to carry Ron's torch and apply for these new positions even if they are needlessly entitled 'molecular' integrated pest manager.

#### REFERENCES CITED

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Lukasz Stelinski  
Entomology & Nematology Dept.  
Citrus Research and Education Center  
University of Florida  
Lake Alfred, FL 33850  
E-mail: stelinski@ufl.edu