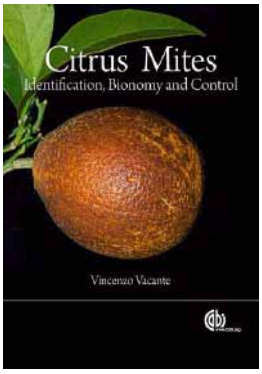
Systematic & Applied Acarology (2010) 15, 36–38. ISSN 1362-1971

Review of a new guide to the identification, biology and control of citrus mites

ZHI-QIANG ZHANG
New Zealand Arthropod Collection, Landcare Research, 231 Morrin Road, St. Johns, Auckland 1072, New Zealand
zhangz@LandcareResearch.co.nz



Vacante, V. (2010)
Citrus mites: Identification, Bionomy and Control
CABI, Wallingford, 378 pp.
ISBN 978-1-84593-498-9 (hardback)
£85.00 / $170.00 / 130.00

Phytophagous mites are among the most important pests of citrus worldwide (Jeppson *et al*. 1975). Gerson (2003) listed over 80 species of mite pests on citrus and provided an overview of their importance, distribution, natural enemies and chemical control. There are several regional reviews of citrus mites: California by McGregor (1956); Florida by Muma (1975); Mediterranean area by Vacante *et al*. (1989) and India by Dhooria *et al*. (2005). However, a single source on the identification, biology and control citrus mites with international coverage has been lacking. Although Jeppson *et al*. (1975) included mites injurious to citrus, it is now out of date. Therefore, this new book on mite identification, biology and control on citrus by Vacante (2010) fills a gap in acarological and pest management literature.

This 378-page book is organized into two main parts. Part I is a general introduction to citriculture, pest mites, their morphology and higher classification, methods and techniques, damage on plants and control. Part II provides a key to phytophagous mite families, subfamilies, tribes, genera and species on citrus, with a separate chapter for each of the seven families of mites and a final chapter providing some concluding remarks. At the end of the book, the list of references (pp. 305–369) and index (pp. 371–378) together accounts for nearly 20% of the book.

The first chapter provides a brief overview of world citriculture, which had a total of harvested area of over 8 million ha in 2007 and export value of US$ 6,935,692,000 (fruits) and US$ 3,930,898,000 (juice) in 2005 according to FAO estimates. Different cultivated species and varieties were discussed and their main producers and world markets listed, mostly based on FAO data in 2008. This chapter briefly introduces a few major mite species and their importance to citrus, but fails to give an introduction to the variety of mite groups treated in Part II. Chapter 2 provides a brief introduction to mite external morphology and higher classification, whereas Chapter 3 briefly describes the methods for collecting, preserving and preparing mites for study. Both these chapters

lack detailed discussions and the readers are referred to corresponding chapters in Krantz and Walter (2009) and other references. Chapter 4 discusses mite feeding and damage symptoms, whereas Chapter 5 reviews major types of pest control (chemical control and its side effects, biological control and integrated pest management). In total, these five short chapters in Part I account for only 10% of the space in the book.

The first chapter of Part II is a key to the mite families, genera and species on citrus. The author admitted that it was compiled from various other works but did not indicate if the key was tested by himself or others, nor did he indicate what kind of background the users need to be able use the key. Obviously it is necessary to have a good compound microscope to use this key. I tested it for *Panonychus citri*, which is the most common species on citrus and it came easily to couplet 93 (*C. citrus* versus *C. elongates*). The sample had no males, so I was not able to key this species any further to separate the two in the couplet because only the difference between male aedeagus is contrasted in the couplet. Comparisons between the descriptions of *C. citrus* (p. 246) and *C. elongates* (p. 256) in Chapter 13 allowed me to distinguish the two species based on females. Thus, this quick test showed one deficiency of the key—the absence of characters of females when they can be distinguished. In general, good keys should provide multiple characters—whenever possible—for identification in the same couplet and preferably easy characters listed first, because sometimes a particular specimen or a sample of specimens may not allow the examination of certain characters. Unfortunately, this key includes many couplets with a single character for separation. It is a bit frustrating to find that the illustrations are scattered in each chapter.

Chapters 7–13 each covers one family of citrus mites and has a similar format: a short introduction to the family and its morphology and classification, followed by systematic treatment of mite taxa with common name(s), diagnosis (with line art illustrations), distribution, biology/ecology and control; for some poorly studied species, the information on biology and control is brief due to lack of reports on these species. These chapters (pp. 55–297) comprise over 60% of the book. However, four of seven chapters are very short and review seven species in total: Phytoptidae (Chapter 7, pp. 55–57, 1 species), Diptilomiopidae (Chapter 9, pp. 101–103, 1 species), Tarsonemidae (Chapter 10, pp. 104–112, 1 species), and Tuckerellidae (Chapter 12, pp. 163–171, 4 species). Chapter 8 on the Eriophyidae covers 13 species, with relatively detailed accounts of two important species: *Aculops pelekassi* and specially *Phyllocoptruta oleivora*. Chapter 11 on the Tenuipalpidae covers 24 species, however, only three important species, *Brevipalpus californicus*, *B. ovatus* and *B. phoenicis*, are discussed in detail regarding their biology and control. The last and the most important chapter is on the Tetranychidae, with accounts of 22 species of spider mites. Detailed discussions are provided for relatively important species such as *Eutetranychus banki*, *Eutetranychus orientalis*, *Eotetranychus sexmaculatus*, *Panonychus citri*, *Tetranychus kanzawai*, *T. ludeni*, *T. neocaledonicus*, *T. pacificus*, *T. turkestani* and *T. urticae*.

In the concluding chapter, the author provides cross-taxon discussions of problems and prospects in systematics, bio-ecology, pest status, natural enemies, methods of control, horticultural practices, prevention, and integrated pest management of citrus mites. After reading the book, I was puzzled why the author used the term "bionomy" in the title of the book but not in any of the chapters (where "bio-ecology" is used in the discussions for various species).

In general, the author has done a fine job in compiling a massive amount of information on citrus mites, their identification, biology and control in a single volume. For books of this length and coverage of different taxonomic groups, it is inevitable that there will be omissions, typographical errors and other errors. However, I noted relatively few. For example, *Brevipalpus junicus* Ma & Yuan, 1982 is tenuipalpid species feeding on citrus in China, but it was not included in chapter 11. The author also missed the recent works on the biological control of citrus pest mites using mass-reared predatory mites in large scales (e.g. Ji *et al.* 2004). The authorship for the family

Tenuipalpidae is Berlese, but was mistakenly attributed to Mitrofanov (p. 45 & p. 155). Likewise the authorship for the subfamily Tetranychinae and tribe Tetranychini is Donnadieu, but was mistakenly attributed to Berlese (p. 194) and Reck (p. 219), respectively. For *Ultratenuipalpus gonianaensis* Sadana & Sidhu, the specific name was mis-printed as *gonianensis* (p. 161, 162, 378).

The book is finished in a nice hardback binding. The publisher's advertised price of US$170.00 seems a bit too high for a book of this size and will likely prevent some libraries and individuals from purchasing it.

References

Dhooria, M.S., Bhullar, M.B. & Mallik, B. (2005) *Mite Pests of Citrus and Their Management in India*, AINP (Agricultural Acarology). UAS, Bangalore, 28 pp.

Gerson, U. (2003) Acarine pests of citrus: overview and non-chemical control. *Systematic & Applied Acarology*, 8, 3–12.

Jeppson, LR, Keifer, H.H. & Baker, E.W. (1975) *Mites Injurious to Economic Plants*. University California Press, Berkeley I–XIX, 613 pp.

Ji, J., Zhang, Y.-X., Hong, X.-Y., Kang, Y.-M., Yu, D-Y. & Lin, J.-Z. (2004) Community structure and dynamics of arthropods in the bio-control orchard released by *Amblyseius cucumeris* (Oudemans) and the chemical control orchard in citrus ecosystem. *Journal of Nanjing Agricultural University*, 27(4), 45–50.

Krantz, G.W. & Walter, D.E. (eds.) (2009) *A Manual of Acarology. Third Edition.* Texas Tech University Press, Lubbock, 816 pp.

Ma, E.-P. & Yuan, Y.-L. (1982) Eight new species of the genus *Brevipalpus* from China, and a study of their spermathecae (Acarina: Tenuipalpidae). *Zoological Research (Supplement October 1982)*, 3, 65–72.

McGregor, E.A. (1956) Mites on citrus trees in southern California. *Southern California Academy of Sciences Memoire*, 3(3), 5–42.

Muma, M.H. (1975) *Mites associated with citrus in Florida. University of Florida, Institute of Food and Agricultural Sciences, Agricultural Experiment Stations Bulletin* 640A, 1–92.

Vacante V., Nucifora A. & Tropea Garzia G. (1989) Citrus Mites in the Mediterranean Area. *In*: Goren, R. & Mendel, K. (Eds) *Proceedings of the Sixth International Citrus Congress.* Tel Balaban Publishers, Aviv, Vol. 3. pp. 1325–1334.

Accepted by O. Seeman 15 Mar. 2010; published 31 Mar. 2010