



OPPORTUNITIES TO REDUCE THE IMPACT OF ACARICIDE TREATMENTS ON THE HIVE

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What impact from the repeated in-hive use of synthetic acaricides?

Onset of Varroa strains carrying drug resistance...

Apidologie 33 (2002) 357–366
 © INRA/DIB-AGIB/EDP Sciences, 2002
 DOI: 10.1051/apido:2002027

357

Original article

First report of *Varroa destructor* resistance to pyrethroids in the UK

Helen M. THOMPSON*, Michael A. BROWN, Richard F. BALL, Medwin H. BEW

Research Article



Received 15 November 2002 Revised 30 October 2003 Accepted article published 4 November 2003 Published online in Wiley Online Library 15 November 2003

(wileyonlinelibrary.com) DOI 10.1002/ps.3679

Point mutations in the sodium channel gene conferring tau-fluvalinate resistance in *Varroa destructor*

Jan Hubert,^a Marta Nesvorna,^a Martin Kamler,^b Jan Kopecky,^a Jan Tyl,^b Dalibor Titera^b and Jitka Stara^{a*}

Apidologie 30 (1999) 229–234
 © Inra/DIB/AGIB/Elsevier, Paris

229

Review article

The resistance of *Varroa jacobsoni* Oud. to acaricides

Norberto Milani

Parasitol Res (2001) 107:1189–1192
 DOI 10.1007/s00436-010-1984-8

ORIGINAL PAPER

Resistance phenomena to amitraz from populations of the ectoparasitic mite *Varroa destructor* of Argentina

Mattias D. Maggi · Sergio R. Ruffinengo · Pedro Negri · Martín J. Eguaras



What impact from the repeated in-hive use of synthetic acaricides?

... increased possibility of residues in hive matrices with negative effects on honeybee health...

OPEN ACCESS Freely available online



Field-Level Sublethal Effects of Approved Bee Hive Chemicals on Honey Bees (*Apis mellifera* L)

Jennifer A. Berry¹, W. Michael Hood², Stéphane Pietravalle³, Keith S. Delaplane^{1*}

Journal of Insect Physiology 58 (2012) 613–620

Apidologie
© INRA/DIB-AGIB/EDP Sciences, 2010
DOI: 10.1051/apido/2010018

Available online at:
www.apidologie.org

Review article



Pesticides and honey bee toxicity – USA*

Reed M. JOHNSON¹, Marion D. ELLIS¹, Christopher A. MULLIN², Maryann FRAZIER²

Direct effect of acaricides on pathogen loads and gene expression levels in honey bees *Apis mellifera*

Humberto Boncristiani^{a,b}, Robyn Underwood^{c,1}, Ryan Schwarz^a, Jay D. Evans^a, Jeffery Pettis^a, Dennis vanEngelsdorp^{c,*}



What impact from the repeated in-hive use of synthetic acaricides?

...and potential synergies with other acaricides, agrochemicals and honeybee pathogens

AGRICULTURE AND SOCIAL INSECTS

Synergistic Interactions Between In-Hive Miticides in *Apis mellifera*

REED M. JOHNSON,¹ HENRY S. POLLOCK, AND MAY H. BERENBAUM

Department of Entomology, 320 Morrill Hall, University of Illinois, 705 S. Goodwin, Urbana, IL 61801-3756

Garrido et al. *Ver Res* (2016) 47:51
DOI:10.1186/s13567-016-0335-z



OPEN ACCESS Freely available online



High Levels of Miticides and Agrochemicals in North American Apiaries: Implications for Honey Bee Health

Christopher A. Mullin¹, Maryann Frazier¹, James L. Frazier¹, Sara Ashcraft¹, Roger Simonds², Dennis vanEngelsdorp¹, Jeffery S. Pettis³

RESEARCH ARTICLE

Open Access



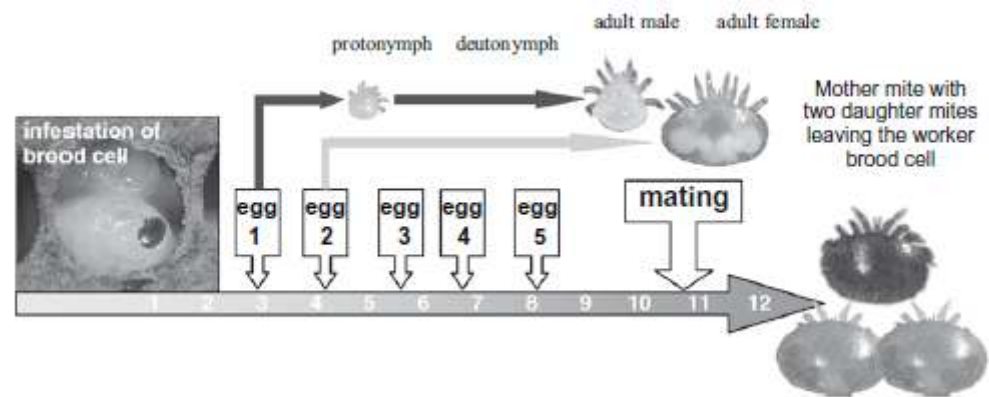
Sublethal effects of acaricides and *Nosema ceranae* infection on immune related gene expression in honeybees

Paula Melisa Garrido^{1*}, Martin Pablo Porrini¹, Karina Antúnez², Belén Branchiccela², Giselle María Astrid Martínez-Noël³, Pablo Zunino², Graciela Salerno³, Martin Javier Eguaras¹ and Elena Ieno⁴



Why to increase the use of natural acaricides?

- Promotion of integrated practices able to reduce:
 1. *conventional chemical treatments*
 2. *varroa loads in the bee brood*





How to increase availability of natural acaricides?

- Contribute to standardization of formulation, dosage and delivery strategy of non-registered products: the case of Neem tree (*Azadirachta indica*)-derived products

Parasitol Res (2010) 107:261–269
DOI 10.1007/s00436-010-1915-x

REVIEW

The efficacy of neem seed extracts (Tre-san®, MiteStop®) on a broad spectrum of pests and parasites

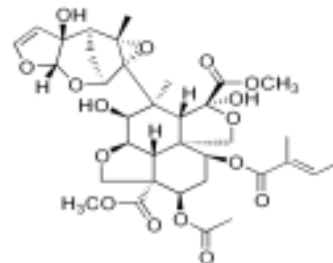
Günter Schmahl · Khaled A. S. Al-Rasheid ·
Fathy Abdel-Ghaffar · Sven Klimpel · Heinz Mehlhorn



Azadirachta indica

- Important source of phytochemicals components, mainly terpenoids (>150)
- Azadirachtin (AZ) is the most significant component and concentration marker
- Neem-derived products (e.g. seed kernel oil) are active on a broad spectrum of pests and parasites of plants, animals and humans
- Low concern for unwanted effects on non-target organisms and for residues in food products (including hive products)

AZ chemical structure





NEEM EXTRACTS VS VARROA MITES *main available studies*

- Oral/topical/vapor administration under *laboratory conditions* (several studies available)
- Topical (spray/trickling) administration under *field conditions*

APICULTURE AND SOCIAL INSECTS

Field Evaluation of Neem and Canola Oil for the Selective Control of the Honey Bee (Hymenoptera: Apidae) Mite Parasites *Varroa jacobsoni* (Acari: Varroidae) and *Acarapis woodi* (Acari: Tarsonemidae)

ADONY P. MELATHOPOULOS, MARK L. WINSTON, ROBIN WHITTINGTON, HEATHER HICO,
AND MONIQUE LE DOUX



Biotechnology & Biotechnological Equipment



ISSN: 1210-2618 (Print) 1214-2520 (Online) Journal homepage: <http://www.tandfonline.com/loi/tbq20>

Controlling honeybee pathogen by using neem and Barbaka plant extracts

Syed Ishtiaq Anjum, Sultan Ayaz, Abdul Haleem Shah, Sanaullah Khan & Shahid Niaz Khan



NEEM EXTRACTS VS VARROA MITES

main available studies

- Repellent effect, acute/starving mortality of mites (multiple day admin)
- Mostly: laboratory studies, phoretic stage of the mite
- Contradictory results about efficacy and tolerability



NEEM EXTRACTS VS VARROA MITES

main issues to be addresses

- Difficult prediction of antivarroa effects in field conditions (e.g. on female mite reproduction)
- Variability of the effects on mites and honeybees due to unstandardized products and application strategies



<http://www.toen.xyz>



<https://www.researchgate.net>



NEEM EXTRACTS VS VARROA MITES

main issues to be addresses

- Need for standardized administration → uniform release and precision of treatment dosage by topical route:
 1. to increase antivarroal effect also on reproductive mites
 2. to reduce potential toxicity on honeybees
 3. to allow better comparison of results from different studies
- Need to avoid repeated treatments at high concentration → issues of safety, time, cost



Seventh European Conference of Apidology, Cluj-Napoca 7-9 September 2016

Effect of Neem (*Azadirachta indica*) oil on varroa mite development in field conditions

M. Mortarino – M. Blonda – S. Zanzani – F. Dellorco - E. Facchini - R. Rizzi





Neem oil vs varroa development: **CONCLUSIONS**

- Pilot test representative of the field conditions
- Commercial product with controlled batch variation
- Uniform and precise delivery method
- Easy administration
- Single application
- Possible recover of the caged comb
- General safety (no dangerous residues)
- Effect on mite reproduction/development within cells

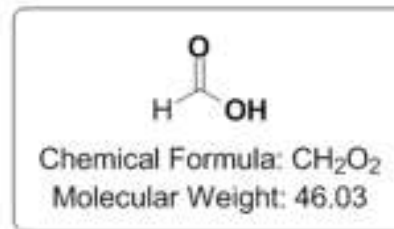


Potential additional tool for integrated mite control strategies



How to increase availability of natural acaricides?

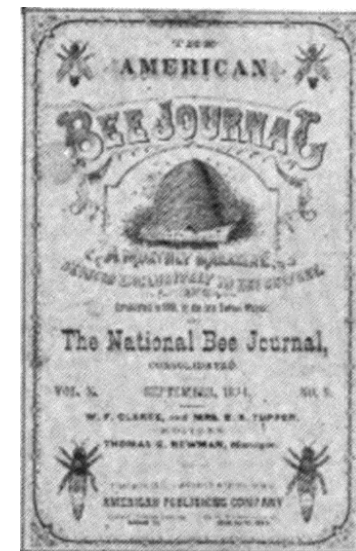
- Improve existing protocols for the use of registered products: the case of Formic Acid (FA)



Trials (and Tribulations) With Formic Acid for Varroa Control

by DR. FRANK A. EESCHEN
Research Entomologist
USDA-ARS

American Bee Journal



October 1998



FORMIC ACID VS VARROA MITES

main characteristics

- Acting by evaporation (quick vs slow)
- Different evaporation supports (liquid, gels strips, etc.)
- Low residues in hive matrices
- Potential to kill both phoretic mites and mites inside brood cells





FORMIC ACID VS VARROA MITES

main issues to be addresses

- **High variability of efficacy and tolerability due to:**
 1. Environmental temperature and relative humidity
 2. Formulation
 3. Dosage
 4. Efficacy of the dispenser (for liquid formulations)
 5. Colony strenght
 6. Evaporation volume (hive type, supers, etc.)
 7. Etc.





Formic Acid field trial in Northern Italy/2015 60 % Liquid vs MAQS formulation

Michele Mortarino - Giovanni Prestini - Livio Colombari – Giovanni Formato

Varroa Control Task Force-WG4 meeting - Unje, 19th-20th 2016

General aims of Varroa Control TF
(coordinators: B. Dainat- G. Formato):

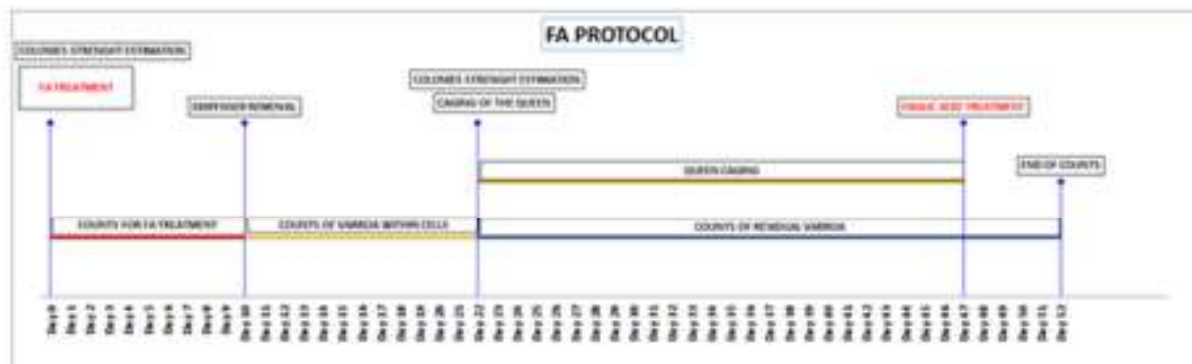
- Study acaricide efficacy and honey bee toxicity of in-use treatments
- Develop novel strategies and improve beekeeping management options against Varroa
- Provide recommendations for sustainable management of Varroa





Formic Acid field trial in Northern Italy/2015: 60 % Liquid vs MAQS formulation

2. "SHORT-TERM PROTOCOL"

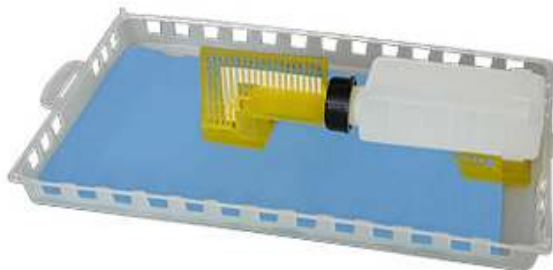


efficacy of the treatment is realized at the end of the formic acid administration (varroa survived counts)

within the Varroa Control Task Force-WG4 Activity (coordinators: B. Dainat- G. Formato):
 a common COLOSS protocol to run FA trials through all the European climate gradient from North to South

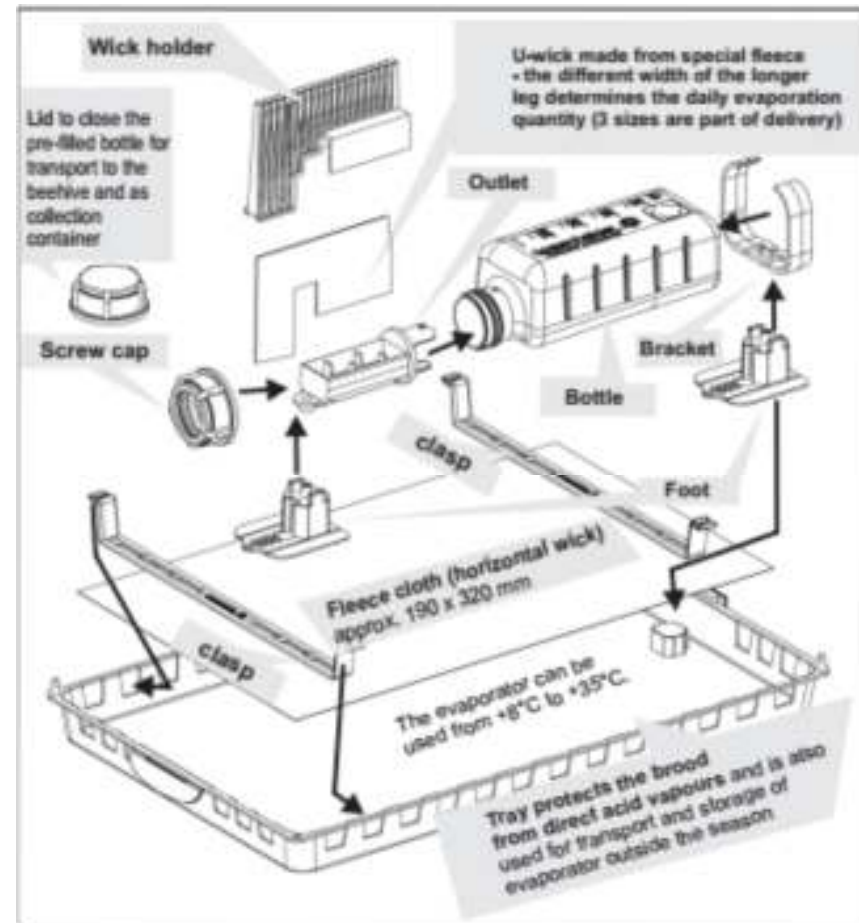


EVAPORATOR: NASSENHEIDER PROFESSIONAL



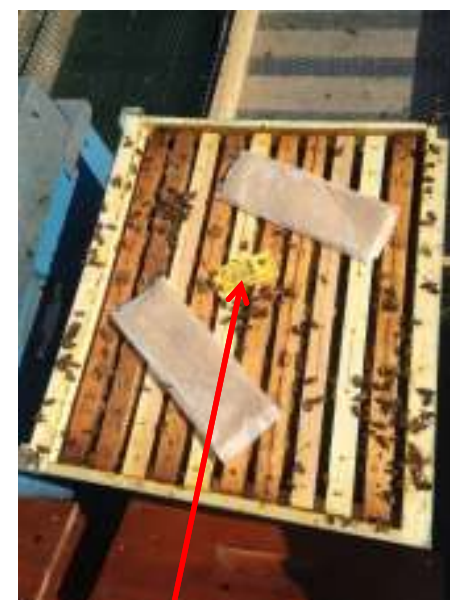
60 % FA for 10/14 days

Colony size / hive type	Daily doses	Filling / Requirement
6-9 honeycombs / offshoot	6-10 ml	140 ml
DNM/ Zander	10-15 ml	180 ml
Dadant DNM/ Zander two	20-25 ml	290 ml (fill completely)





THE TREATMENTS



Datalogger (inside a queen cage)





Liquid FA vs varroa: CONCLUSIONS

- Collaborative field trials → still ongoing
- Better understanding of intra-colony and environmental parameters (microclimate) influencing tolerability and efficacy
- NP: cheap, adjustable delivery with reduced dependance to T° and RH conditions





UniMi

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GRAZIE

