

STAFF

Microbial ecology

- [Mogens Nicolaisen, professor](#)
- Mette Vestergård, tenure track scientist
- Susana Santos, post doc
- Enoch Kudjordjie, PhD student
- Maniruzzaman Sikder, PhD student
- Kourosh Hooshman, PhD student
- 2-3 coming post docs

Rust diseases

- [Mogens Hovmøller, professor](#)
- [Annemarie Fejer Justesen, senior scientist](#)
- Chris Khadgi Sørensen, scientist
- Julian Algaba, scientist
- Tine Thach, scientist
- Mehran Patpour, scientist
- Kamran Saleem, PhD student
- Nikolaj Vendelboe, PhD student

Entomology

- [Annie Enkegaard, senior scientist](#)
- [Michael Kristensen, associate professor](#)
- [Henrik Skovgaard, senior scientist](#)
- [Tove Steenberg, senior scientist](#)
- [Niels Holst, senior scientist](#)
- Rasmus Emil Jensen, PhD student
- Zahid Mahmood, PhD student

Bee research

- [Per Kryger](#)
- [\(Niels Holst\)](#)
- [\(Annie Enkegaard\)](#)



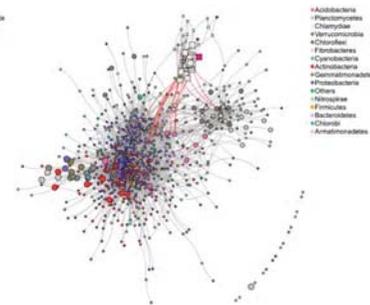
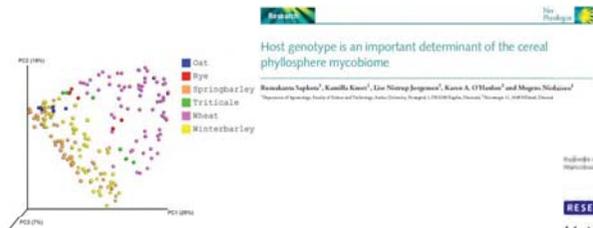
PLANT PATHOLOGY AND ENTOMOLOGY - PATENT



MICROBIAL ECOLOGY

Microbiomes and effects on plant health

- Plant effects on microbiome
- Soil effects on microbiome
- Agro-manipulation of microbiomes



FOCUS AREAS

Microbial ecology:

- Plant-microbiome interactions
 - Nematodes/funghi/bacteria
- Monitoring/diagnostics

Rust diseases:

- Pathogen virulence and evolution
- Histopathology
- Global Rust Reference Center

Bee research:

- Honey bee genetics
- Honey bee diseases
- Pollination

Entomology:

- Biological control
- Entomopathogenic fungi
- Pesticide resistance



CURRENT PROJECTS

Clever plants design their root-associated microbiome to avoid disease
Independent Research Fund Denmark

Diversity of phytoplasmas
Horizon 2020

Disclosing soil microbial friends and foes of plant pathogenic nematodes
Aarhus University Research Foundation

Protective microbiomes on plant pathogenic nematodes
Independent Research Fund Denmark

NEMATATOLOGY

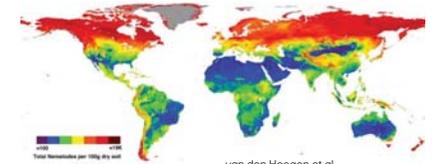
Interactions between soil microorganisms and plant pathogenic nematodes

Identity of nematode antagonistic microorganisms
 Mechanisms of microbial nematode suppression/control
 Nematode-protective surface microbiomes



Local to global distribution of soil nematodes

- communities and plant parasitic species



van den Hoogen et al.,
 in revision, *Nature*

Plant species effects
 Land use effects
 Edaphic factors
 Agricultural practices
 Biogeographical patterns

Rust research activities

I: Genetic diversity, migration pathways and pathogen evolution at local,

regional and global scales

Analyses of rust samples from

Plant Pathology

Replacement of the European wheat yellow rust population by new races from the centre of diversity in the near-Himalayan region

M. S. Hovmøller^{1,2}, S. Waffar¹, R. Bailey², A. Hovgaard³, A. Fakhri⁴, H. Goumard⁵, M. Lecomte⁶, P. Chantreau⁷, J. Rodriguez-Algaba⁸, T. Thach⁹, J. G. Hansen¹, P. Lassus¹⁰, A. F. Jørgensen¹, S. Ali¹¹ and C. de Vallavethil-Puga¹²

DOI: 10.1111/ppa.12433

This article is accepted for publication in *Plant Pathology*.



Ecology and Evolution

Molecular markers for tracking the origin and worldwide distribution of invasive strains of *Puccinia striiformis*

Stephanie Walter¹, Sigit Ali^{2,3}, Erik Kasper⁴, Kuntana Naeem⁵, Bushra A. Sabir⁶, Antoinette Engelbert⁷, Jens B. Hansen⁸, James C.M. Bacon⁹, Thomas Scheerer-Petersen¹⁰, Jonathan Jones¹¹, Clotilde de Vallavethil-Puga¹², Mogens S. Nielsen¹³ & Anette K. Jensen¹⁴

Yellow Rust Epidemics Worldwide Were Caused by Pathogen Races from Divergent Genetic Lineages

Stephanie Walter¹, Sigit Ali^{2,3}, Erik Kasper⁴, Kuntana Naeem⁵, Bushra A. Sabir⁶, Antoinette Engelbert⁷, Jens B. Hansen⁸, James C.M. Bacon⁹, Thomas Scheerer-Petersen¹⁰, Jonathan Jones¹¹, Clotilde de Vallavethil-Puga¹², Mogens S. Nielsen¹³ & Anette K. Jensen¹⁴

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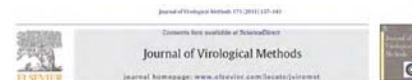
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DIAGNOSIS AND MONITORING

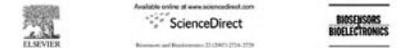
Demand driven development of methods:



Real-time PCR for quantification of eleven individual *Fusarium* species in cereals
 Mogens Nicolaisen^{1,2}, Madsur Suprem³, Lene Gørggaard Nielsen⁴, Jørgen Lassen⁵, Mette Thorsbø Spilth⁶, Anette Marie Fyfe Jørgensen⁷



An oligonucleotide-based microarray for detection of plant RNA viruses
 Mogens Nicolaisen¹



Short communication
 Detection of fungal spores using a generic surface plasmon resonance immunoassay
 Peter Skottrup^{1,2,3}, Stephen Heary⁴, Hans Frøkjær⁵, Paul Leonard⁶, Jens Heigaard⁶, Richard O'Kennedy⁷, Mogens Nicolaisen⁸, Anette Marie Fyfe Jørgensen⁹

MPM Vol. 17, No. 11, 2014, pp. 1175-1184. Publication No. M-2014-008-010 © 2014 The American Phytopathological Society

Technical Advance
 Distribution of Phytoplasmas in Infected Plants as Revealed by Real-Time PCR and Bioimaging

Nynne Meyn Christensen¹, Mogens Nicolaisen², Michael Hansen³, and Alexander Schulz⁴
¹Department of Plant Biology, The Royal Veterinary and Agricultural University, Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark; ²Danish Institute of Agricultural Sciences, Department of Crop Protection, Research Centre Flakkebjerg, DK-4200 Slagelse, Denmark

ENTOMOLOGY – DRONES FOR BIOLOGICAL CONTROL

- A challenge for augmentative biocontrol in outdoor crops is obtaining an even distribution of natural enemies (NE) - labour-intensive and time-consuming
- To increase implementation in outdoor crops – use drones for NE distribution
- Target crops: orchards, strawberry, vegetables, Christmas tree plantations, oil seed rape, ...
- Necessitate the survival and function of NE after release
- Studies on survival/function for a variety of commercial NE: ladybeetle, aphid gallmidge, several predatory mites and parasitoids, rove beetle
- Attempts to develop rearing methods for as-yet uncommercialised NE: carabids
- Collaboration with 2 private companies (Drone-developer; producer of NE)



ENTOMOLOGY – ENTOMOPATHOGENIC FUNGI AS ENDOPHYTES

- Entomopathogens (bacteria, viruses, fungi) are used in biocontrol of pests
- Entomopathogenic fungi may also live as endophytes in plants, then called EEF
- EEF may affect e.g. plant nutrient acquisition, plant signalling and plant defence against herbivores
- AIM: What are the multiple trophic interactions between EEF-plants, herbivores and natural enemies (NE)? To ultimately improve integration of EEF in biocontrol programs
- Model organisms: broad bean, *Beauveria bassiana*, black bean aphid, predatory *Orius*-bug, aphid parasitoid
- Studies: effect of EEF on aphids; effect of EEF on predation and parasitism; effect of EEF on plant volatile communication with NE; effect NE preference between EEF- and non-EEF-plants



GRRC research activities

II: Disease epidemiology and pathogen genetics

➔ Pathogen "aggressiveness", adaptation to high/low temperatures, genetic basis for virulence, infection biology, genetic studies of rust fungi using the alternate host *Berberis spp.*, e.g.. genetic basis for virulence and aggressiveness, use of genetic library of world-wide reference isolates, modeling, etc.



DEPT OF AGROECOLOGY

Rodriguez-Algaba 2017



GRRC research activities

III: Host-pathogen interactions: From cell to ecosystem, advanced microscopy and histopathology, evolution of virulence, phenotyping and functional analyses of disease resistance, utilizing world-wide reference collections of host and pathogen resources



EVALUATION OF DEPT OF AGROECOLOGY 27 MAY 2019



HONEY BEE POPULATION GENETICS

- SmartBees an EU FP7 2014-2018
- Improving honey bee genetics
- Subspecies differentiation based on 4000 SNPs
- To be used for the conservation of the natural European honey bee populations
- Applying Machine Learning to differentiate Europe's 11 natural subspecies



Entomology

EvoPPM - Evolution-proof Pest Management

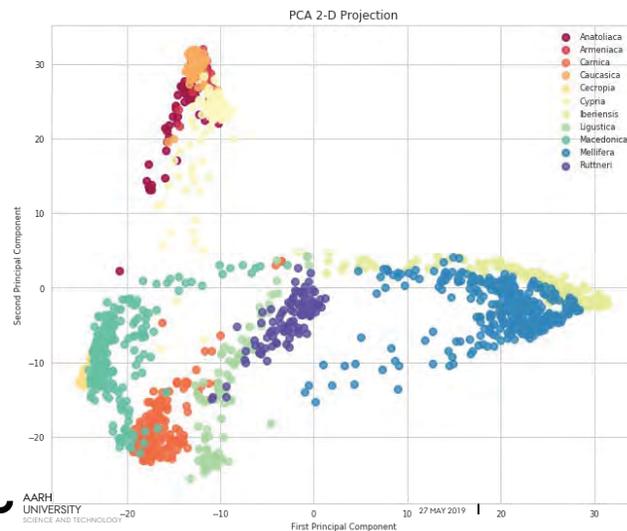
Microevolution of pesticide resistance

If we understand the molecular details and the evolutionary dynamics, we can interfere with the system in the best manner with regard to both the economy and the environment to control pests and avoid resistance.

- **Frame:** 2014-2018, funded by Innovation Fund Denmark and Bayer CropScience, 2.6 mill Euro.
- **Results:** 3 PhD's, 3 postdocs, >24 peer-review papers, >20 dissemination papers in magazines and media, multiple talks and posters at meetings.
- Continued as smaller projects on specific pests and in general dissemination in the context of IPM.



SmartBees SNP subspecies differentiation



HONEY BEE HEALTH



- Quantitation of honey bee viruses for diagnosis
- The role of varroa mites in transmitting virus
- Sexual transmission of viruses in honey bees
- Honey bee diseases in relation to beekeeper skills
- Varroa mites threshold and integrated management
- Computer aided detection of varroa mites
- Education and training of beekeepers





AARHUS
UNIVERSITY

HONEY BEE NUTRITION AND POLLINATION



- Nutrition impacts honey bee health
- Secondary metabolites in pollen and bee bread
- Interaction between nutrition and pesticides
- Improving pollination of white clover, red clover and alfalfa, applying honey bees in tunnels
- Role of pollination in plant disease transmission
- Honey bees role in natural ecosystems



Public advice

Statutory plant health

Pest risk assessments
Pest-specific datasheets
Horizon scanning
Diagnostics



Cover all pests and pathogens

Bees

Bee health
Bee genetics
Organic honey

Pests

Efficacy evaluations of biocides

