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Catching cereal killers: a multi-omics approach to disentangle yeast-Fusarium interactions in the phyllosphere

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Citation

Gouka, L. (2025, October 15). *Catching cereal killers: a multi-omics approach to disentangle yeast-Fusarium interactions in the phyllosphere*. NIOO-thesis. Retrieved from <https://hdl.handle.net/1887/4266952>

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Note: To cite this publication please use the final published version (if applicable).

Curriculum vitae

Linda Gouka was born on January 25th, 1996, in The Hague, the Netherlands. With a broad scientific curiosity, she embarked on a Biology degree at Leiden University in 2014. During her first internship, under the supervision of Dr. Anne van der Meij and Prof. Dr. Gilles van Wezel in the Department of Molecular Biotechnology, she completed her BSc thesis on the characterization of endophytic Actinomycetes and the role of plant hormones in activating silent biosynthetic gene clusters. This experience sparked her fascination with the ability of microorganisms to produce secondary metabolites, shaping the direction of her future research.

In 2017, Linda pursued an MSc in Molecular Genetics and Biotechnology at Leiden University, undertaking another internship in the same research group but shifting her focus toward chemistry. Under the supervision of Dr. Lizah van der Aart, she investigated the peptidoglycan composition of different SALP mutants of *Streptomyces coelicolor* and assessed the influence of ampicillin. For her final MSc internship, she worked under Dr. Mariana Avalos and Prof. Dr. Jos Raaijmakers, exploring the antifungal potential of oxalic acid-degrading bacteria. This project, a collaboration between Leiden University and the Netherlands Institute of Ecology (NIOO-KNAW) in Wageningen, combined laboratory work with bioassays on sugar beets. It was during this time that Linda solidified her passion for plant-microbe interactions. Beyond her academic pursuits, Linda was actively involved in promoting the Biology program at Leiden University as a Biology Ambassador. In her free time, she played tennis at the highest competitive level at her local club.

After completing her Master's degree, Linda joined Bayer Crop Science in Bergschenhoek as a research assistant in the Seed Health Quality Testing department. There, she contributed to molecular biology and biotechnology assays within a global research and development team, collaborating with both technical and non-technical groups.

A year later, she joined the MATRIX team at the Netherlands Institute of Ecology under the supervision of Prof. Dr. Jos Raaijmakers and Dr. Viviane Cordovez in the Department of Microbial Ecology. For her PhD, she investigated yeast-*Fusarium* interactions in the wheat phyllosphere using a multi-omics approach, the findings of which are presented in this thesis. Linda's aspiration is to continue her career in academia. She remains part of the MATRIX team as a postdoctoral researcher, where she now applies her PhD expertise to large-scale field trials in Denmark.



List of publications

1. Gouka, L., Raaijmakers, J. M., & Cordovez, V. 2022. Ecology and functional potential of phyllosphere yeasts. *Trends in Plant Science* 27: 1109 – 1123. (Chapter 2 of this thesis)
2. Gouka, L., Vogels, C., Hestbjerg Hansen, L., Raaijmakers, J. M., & Cordovez, V. 2022. Genetic, Phenotypic and Metabolic Diversity of Yeasts from Wheat Flag Leaves. *Frontiers in Plant Science* 13: 908628. (Chapter 3 of this thesis)
3. Marchi, M., Bosc-Bierne, A., Lerenard, T., Le Corff, J., Aligon, S., Rolland, A., Simonin, M., Marais, C., Briand, M., Cordovez, V., Gouka, L., Guillemette, T., Simoneau, P., Guschinskaya, N. 2024. Unexplored Yeast diversity in Seed Microbiota. *BioRxiv*.
4. Gouka, L., Serra I Melendez, C., Vardazaryan, N., Nor Nielsen, K., Riber, L., Hestbjerg Hansen, L., Raaijmakers, J. M., Seidl, M. F., Melkonian, C., Cordovez, V. 2024. Genomic signatures and adaptive traits of phyllosphere yeasts. Under review. (Chapter 4 of this thesis)
5. Gouka, L., Groen, E., Hestbjerg Hansen, L., Raaijmakers, J. M., Cordovez, V. 2025. Chemical Ecology in the phyllosphere: yeast-*Fusarium* interactions and mycotoxin modulation. Under review. (Chapter 5 of this thesis)

Acknowledgements

A PhD is shaped by many factors, but the most important is the supervision team that guides you along the way. I'm incredibly grateful to **Viviane, Jos,** and **Lars** for giving me the opportunity to embark on this journey. Before starting, I was advised to find a team that excels in science and fosters a supportive, welcoming environment. **Jos**, that's exactly what I found in your group. Thank you for being such an open and enthusiastic scientist—and above all, for being human. Over the past four and a half years, you helped me navigate an overwhelming number of experiments, kept me motivated, and encouraged me to stay positive.

Vivi, thank you for being my daily supervisor and always keeping your door open. I must have driven you crazy—especially in the final months—every time I came in with a “new idea”. I'm so grateful you trusted and supported me, no matter how ambitious my ideas were. I'm incredibly proud to have been your first official employee and look forward to continuing with the Cordovez team as a Postdoc (hopefully longer!).

Lars, thank you for being part of my promoters team. I really enjoyed our monthly meetings and especially visiting your group in Denmark. Despite our first meeting being disrupted by COVID, you always made me feel welcome.

A special thank you to one of my paranymphs, **Luisa**—also my office mate. Thank you for listening to my “minor complaints,” my bakery/farm dreams, and for all our lunch outings and Spanish-Dutch chats—¡muchas gracias amiga!

To my fellow PhDs in the MATRIX consortium—**Marie, Peter,** and **Laura**—thank you for all the science, beer tasting, and travels abroad, especially the Phyllosphere meeting in Berkeley and the Plant Microbiome meeting in Ecuador. To the rest of the MATRIX team—**Knud, Ewa, Jan, Alex, Tomas,** and **Leise**—thank you for your contributions along the way.

This thesis would not have been possible without the brilliant students who contributed to its chapters: **Tjeu, Emma, Dewi, Sam, Niels, Fiona,** and **Cristina**. I hope you learned as much from me as I did from supervising you. I really enjoyed working with you in the lab and behind the computer.

To all my colleagues in the Microbial Ecology (ME) department: **Azkia, Dieke, Marcelle, Raul, Xinya, Ohana, Mahdere, Muhammad, Lena, Luzia, Eline, Brandon, Christina, Stijn, Cristina, Dario, Lhais, Einar, Thomas, Gabriel, Jose, Victoria, Akari, Stalin, Germán, Késia, Deborah, Han, Jiayi, Jie, Luc, Mark, Eiko, Paul, Wietse, Mattias, Paolina, Sascha, Desalegn, Nejc,** and **Very**, thank you for making this journey enjoyable.

A huge thanks to the incredible assistants who helped me throughout: **Caroline**, it was a joy establishing this culture collection with you, you're so positive and fun to work next to. **Hans**, thank you for your expertise, but more so for being such a supportive presence.

Agata, thank you for your help with the molecular work. **Gregor**, thanks for your tips on caring for our wheat plants... even after four years, they were a struggle! **Jeroen**, thank you for all the tasty lunches and your friendly energy.

Thanks also to the NIOO research staff who keep everything running smoothly, **Domini-ka**, **Saskia**, **Maria**, **Paulien**, **Marion**, **Ciska**, **Tanja**, **Roos**, and **Iris**. And thank you to my collaborators who have increased the level of this thesis significantly, **Nelli**, **Chrats**, and **Michael**.

A heartfelt thank you to **Lena**, **Luzia**, **Luisa**, **Ohana**, **Jie**, **Mahdere**, **Christina**, and my dad for proofreading this thesis, and a big thank you to **Cristina** for creating the cover and illustrations.

To my friends and family, thank you for your unwavering support. **Felice**, my PhD writing buddy at the Coffee Company, thank you for sharing both motivation and procrastination during the final stretch.

To my parents, **Robin** and **Jacqueline**, thank you for always showing interest in my research, listening to countless complaints, and even helping with biology when needed. Most of all, thank you for reminding me that this is just a job.

And last, but certainly not least, **Erwin**. Thank you for always being there, supporting my career, offering advice (that I rarely took), and providing much-needed wine. You even joined me on weekends to help wrap Petri dishes in plastic film.

Thank you all, not just for contributing to my academic journey, but for shaping me as a person as well.

Education Statement of the Graduate School

Experimental Plant Sciences

Issued to: Linda Gouka
 Date: 15 October 2025
 Group: Microbial Ecology
 University: Leiden University & Netherlands Institute of Ecology (NIOO-KNAW)

1. Start-Up Phase		date	cp
»	First presentation of your project		
	Diversity and Functions of Phyllosphere Yeasts	10-11-2020	1.5
»	Writing or rewriting a project proposal		
	Diversity and Functions of Phyllosphere Yeasts	30-01-2021	6.0
»	MSc courses		
<i>Subtotal Start-Up Phase</i>			7.5
2. Scientific Exposure		date	cp
»	EPS PhD days		
	EPS PhD days 'Get2Gether', Soest (NL)	03/04-05-2022	0.6
	EPS PhD days 'Get2Gether', Soest (NL)	01/02-05-2023	0.6
»	EPS theme symposia*		
	EPS theme 2 'Interactions between Plants and Biotic Agents, Wageningen (NL)	26-10-2023	0.3
»	National platform meetings		
	Annual Meeting 'Experimental Plant Sciences' (online)	12/13-04-2021	0.5
	Annual Meeting 'Experimental Plant Sciences', Lunteren (NL)	11/12-04-2022	0.6
	Annual Meeting 'Experimental Plant Sciences', Lunteren (NL)	17/18-04-2023	0.6
	3rd Conferen of the Netherlands Society for Evolutionary Biology (NLSEB) (online)	19/20-04-2021	0.6
»	Seminars (series), workshops and symposia		
	NIOO-wide seminar at NIOO-KNAW	22-11-2021	0.1
	Metabolomics workshop online organized by MATRIX	10-11-2021	0.2
	Volatile Organic Compounds analysis workshop	04-02-2022	0.1
	Introduction to Bioinformatics workshop at NIOO-KNAW	17-10-2022	0.2
	How to perform mzMine analysis workshop at NIOO-KNAW	21-11-2022	0.2
	Agilent Masshunter LC-qTOF training at NIOO-KNAW	22-02-2023	0.3
	Agilent Masshunter GC-qTOF & GC-MS training at NIOO-KNAW	03-03-2023	0.3
	Volatile analysis study group workshop at NIOO-KNAW	25-10-2023	0.1
	Untargeted Volatilomics Analysis workshop at NIOO-KNAW	27-01-2023	0.1

	Untargeted Volatilomics Analysis workshop at NIOO-KNAW	03-02-2023	0.1
	Untargeted Volatilomics Analysis workshop at NIOO-KNAW	10-02-2023	0.1
»	Seminar plus		
»	International symposia and congresses		
	15th International Congress on Yeasts meets the 30th International Conference on Yeast Genetics and Molecular Biology (ICY15 meets ICYGMB30) (online)	23/27-08-2021	1.5
	MiCROPe Symposium, Vienna (AT)	11/14-07-2022	1.2
	Phyllosphere 2022 Conference, Davis (US)	18/21-07-2022	1.2
	Copenhagen Bioscience Conference: Plant-Microbe Interactions, Hillerød (DK)	13/17-11-2022	1.2
	4th Plant Microbiome Symposium, Quito (EC)	01/04-08-2023	1.2
»	Presentations		
	Poster presentation at ICYGMB30 (online)	24-08-2021	1.0
	Oral presentation for NIOO-KNAW-wide seminar series	22-11-2021	1.0
	Oral presentation at the Annual meeting 'Experimental Plant Sciences' in Lunteren (NL)	11-04-2022	1.0
	Oral presentation at the EPS PhD days 'Get2Gether' in Soest (NL)	03-05-2022	1.0
	Oral presentation at the Phyllosphere 2022 Conference in Davis (US)	21-07-2022	1.0
	Poster presentation and prize at Plant-Microbe Interactions in Hillerød (DK)	14-11-2022	1.0
	Poster presentation and prize at 4th Plant Microbiome symposium in Quito (EC)	02-08-2023	1.0
	Oral presentation at 4th Plant Microbiome Symposium in Quito (EC)	03-08-2023	1.0
	Oral presentation at EPS Theme 2 'Interactions between Plants and Biotic Agents' in Wageningen (NL)	26-10-2023	1.0
»	Interviews		
	3rd year interview with an EPS research theme coordinator	13-06-2023	0.7
»	Excursions		
<i>Subtotal Scientific Exposure</i>			21.6

3. In-Depth Studies		date	cp
»	Advanced scientific courses & workshops		
	EPS Bioinformatic Introduction Course	10/14-07-2024	1.5
	EPS CRISPR/Cas course	16/17-11-2023	0.6
»	Journal Club		
»	Individual research training		
	Visit to University of Copenhagen to work in the biochemistry department with Prof. Dr. Jan H. Christensen	13/17-12-2021	1.5
<i>Subtotal In-Depth Studies</i>			3.6

4. Personal Development		date	cp
»	General skill trainings courses		
	Scientific Conduct for PhDs (Science)	17-10-2024	0.3
	Adobe InDesign - from Dissertation Layout to Poster Design (online)	7/28-11-2023	1.1
	Writing Grant Proposals (online)	8-11-2023 - 24-01-2024	2.0
»	Organisation of scientific meetings, PhD courses or outreach activities		
»	Membership of EPS PhD Council		
<i>Subtotal Start-Up Phase</i>			3.4
5. Teaching & Supervision Duties		date	cp
»	Courses		
»	Supervision of BSc/MSc projects		3.0
	HBO Student 'Degradation of methanol and mycotoxins by phyllosphere microorganisms'	01-09-2021 - 01-04-2022	
	HBO student 'Wheat leaf colonization of <i>Aureobasidium</i> sp. and its inhibitory effect on <i>Fusarium graminearum</i> growth and mycotoxin production'	13-02-2023 - 03-07-2023	
	HBO student 'Volatile Affairs in the Phyllosphere'	20-02-2023 - 10-07-2023	
	MSc student 'Spatiotemporal distribution of foliar yeasts in the wheat phyllosphere and their biocontrol potential against the fungal pathogen <i>Fusarium graminearum</i> '	13-04-2023 - 13-10-2023	
	MSc student 'Exploring yeast-based biological control agents for Fusarium Head Blight management in wheat'	01-10-2023 - 01-04-2024	
	HBO student 'Molecular and chemical interactions among phyllosphere microorganisms'	01-02-2024 - 01-07-2024	
<i>Subtotal Teaching & Supervision Duties</i>			3.0
Total number of credit points**			39.1

Herewith the Graduate School declares that the PhD candidate has complied with the educational requirements set by the Educational Committee of EPS with a minimum total of 30 ECTS credits.

* Exemption for minimal requirement of 2x attending an EPS theme symposium, due to personal circumstances.

** A credit represents a normative study load of 28 hours of study.