

MSc course Microbial Horticulture (BI1429)  
Anna Karin Rosberg 2023

### **Course books – online access and library copies**

Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3

Link: <https://www.sciencedirect.com/book/9780123946263/environmentalmicrobiology>

Barker K. 2004. At the bench - a laboratory navigator. 2nd ed. Cold Spring Harbor Laboratory Press; ISBN: 978-0-87969708-2.

**Literature assignments week by week** (scientific publications can be found online, but will also be provided on the Canvas course page where each lecture has its own page):

### **Week 1**

#### **Good laboratory practice and biosafety**

##### Mandatory literature:

- Arbetsmiljöverket. 2011. Contained use of genetically modified microorganisms. AFS 2011:2.
- Barker K. 2004. At the bench - a laboratory navigator. 2nd ed. Cold Spring Harbor Laboratory Press; ISBN: 978-0-87969708-2; chp 1-9.
- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3, ch 1

##### Recommended literature regarding Swedish regulations:

- Arbetsmiljöverket. 2018. Smittrisker. AFS 2018:4.
- Arbetsmiljöverket 2018b. Innesluten användning av genmodifierade mikroorganismer. AFS 2018:9.

#### **Introduction to the lab driving license and writing of laboratory reports**

##### Mandatory literature:

- Alsanius B. 2018. Instruction for skillful writing of laboratory reports. SLU: Alnarp.
- Barker K. 2004. At the bench - a laboratory navigator. 2nd ed. Cold Spring Harbor Laboratory Press; ISBN: 978-0-87969708-2; chp 1-9.

## **Involvement of microorganisms in horticultural production networks**

### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3, ch 1
- LEBEIS , S. L. 2015. Greater than the sum of their parts: characterizing plant microbiomes at the community-level. *Current Opinion in Plant Biology*, 24, 82–86.
- VANDENKOORNHUYSE , P., QUAISER, A., DUHAMEL, M., LE VAN, A. & DUFRESNE, A. 2015. The importance of the microbiome of the plant holobiont. *New Phytologist*, 1-11; doi: 10.1111/nph.13312

### **Recommended literature:**

- MEYER , K. M. & LEVEAU, J. H. J. 2012. Microbiology of the phyllosphere: a playground for testing ecological concepts. *Oecologia*, 168, 621-629.
- MOGREN , L., WINDSTAM, S., BOQVIST, S., VÅGSHOLM, I., SÖDERQVIST, K., ROSBERG, A. K., LINDÉN, J., MULAOSMANOVIC, E., KARLSSON, M. E., UHLIG, E., HÅKANSSON, Å. & ALSANIUS , B. W. 2018. The Hurdle Approach—A Holistic Concept for Controlling Food Safety Risks Associated With Pathogenic Bacterial Contamination of Leafy Green Vegetables. A Review. *Frontiers Microbiology*, 9, 1965.

## **Microbial morphology**

### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. ch 2, 4-7.

## **Microbial growth and growth control**

### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. ch 3, 11.

## **Microorganisms associated with plants**

### **Mandatory literature:**

- TURNER, T., JAMES, E., POOLE, P., 2013 The plant microbiome, *Genome Biology*, 14, 209-219

## **Week 2**

### **The microbial world (taxonomy)**

#### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. ch 2, 4-7.

## **Biofilms and horticulture**

### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. ch.6.2.4, 117-119, 20
- Ramey, BE. et al. 2004. Biofilm formation in plant microbe associations. Current opinion in microbiology. 7, 602-609, doi: 10.1016/j.mib.2004.10.014
- Annous, BA. et al. Quorum sensing in biofilms: Why bacteria behave the way they do. Journal of food science. 74, Nr 1. doi:10.1111/j.1750-3841.2008.01022.x

### **Recommended literature:**

- Bogino, PC. et al. 2013. The role of Bacterial biofilms and surface components in plant-bacterial associations. Int. J. Mol. sci. 14, 15838-15859, doi:10.3390/ijms140815838

## **Week 3**

### **Soil microbiology**

#### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. ch 16.
- Fierer N. 2017. Embracing the unknown: disentangling the complexities of the soil microbiome. *Nature Reviews: Microbiology*. Vol. 15. 579-590.

#### **Recommended literature:**

- ALLEN D.E., SINGH B.P. & DALAL R.C. 2011. Soil Health Indicators, Soil Health and Climate Change: Background. p.25-49 . In: ed. Singh B.P., Cowie A.L. & Chan K.Y. 2011. Soil Health and Climate Change. Soil Biology, vol. 29. Springer. pp. 403.

*Reading recommendation sections 2.1 and 2.4!*

## **Fertilization**

### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. ch 16.
- Jacoby R., Peukert M., Succurro A., Koprivova A. & Kopriva S. 2017. The Role of Soil Microorganisms in Plant Mineral Nutrition - Current Knowledge and Future Directions. *Frontiers in Plant Science*. Vol. 8. Article 1617.

### Recommended literature:

- NIHORIMBERE V., ONGENA M., SMARGIASSI M. & THONART P. 2011 . Beneficial effect of the rhizosphere microbial community for plant growth and health. *Biotechnology, Agronomy, Society and Environment*. 15:2, 327-337. *Reading recommendation specifically sections 3 and 5!*

### Compost

#### Mandatory literature:

- VAN DER WURFF, A., FUCHS, J. G., RAVIV, M. & TERMORSHUIZEN, A. (eds.) *Handbook for composting and compost use in organic horticulture*. Wageningen: [www.biogreenhouse.org](http://www.biogreenhouse.org).
- Assessment of treatment methods and validation criteria for composting and biogas facilities in relation to plant health risks and the risk of spreading alien organisms

### Symbiotic nitrogen fixation

#### Mandatory literature:

- Kiers, E. T., Rousseau, R. A., West, S. A., Denison, R.F. 2003. Host sanctions and the legume–rhizobium mutualism. *Nature* 425, 78-81.
- Oono, R., Anderson, C.G., Denison, R. F. 2011. Failure to fix nitrogen by non-reproductive symbiotic rhizobia triggers host sanctions that reduce fitness of their reproductive clonemates. *Proc. R. Soc. B* (2011) 278, 2698–2703. doi:10.1098/rspb.2010.2193
- Werner, G. D. A., Strassmann, J. A., Ivens, A. B. F., Engelmoer, D. J. P., Verbruggen, E., Queller, D. C., Noëf, R., Johnson, N. C., Hammerstein, P., Kiers, E. T., 2014. Evolution of microbial markets. *PNAS* 111 (4): 1237-1244.

### Mycorrhiza

#### Mandatory literature:

- NOË R., KIERS E.T. 2018. Mycorrhizal markets, firms and Co-ops. *Trends in Ecology & Evolution*, 33, 777-789.
- WERNER G. D. A., KIERS E.T. 2015. Partner selection in the mycorrhizal mutualism. *New Phytologist*, 205, 1437-1442.

### Introduction to methods in microbial horticulture

#### Mandatory literature:

- Pepper IL, Gerba CP, Gentry TJ. 2015. *Environmental Microbiology*. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. ch 8-13.

### **Phenotypic microarray**

- BOCHNER, B. R. & SAVAGEAU, M. A. 1977. Generalized indicator plate for genetic, metabolic, and taxonomic studies with microorganisms. *Applied and Environmental Microbiology*, 33, 434-444.
- BOCHNER, B. R., GADZINSKI, P. & PANOMITROS, E. 2001. Phenotype MicroArrays for high-throughput phenotypic testing and assay of gene function. *Genome Research*, 11, 1246-1255.

### **Phospholipid fatty acid analysis**

- Frostegård, Å.; Tunlid, A.; Bååth, E. 2011. Use and misuse of PLFA measurements in soils. *Soil Biology and Biochemistry*, 43 (8), 1621–1625.
- Kaur, A., Chaudhary, A., Kaur, A., Choudhary, R., Kaushik, R. 2005. Phospholipid fatty acid - A bioindicator of environmental monitoring and assessment in soil ecosystem *Current Science*, 89 (7), 1103–1112.

### **Serological methods**

- Schaad, N.W. 1979. Serological identification of plant pathogenic bacteria. *Annual Reviews of Phytopathology*, 17, 123-147
- Pepper IL, Gerba CP, Gentry TJ. 2015. *Environmental Microbiology*. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. Chapter 12

## **Week 4**

### **Introduction to DNA-based methods**

#### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. *Environmental Microbiology*. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. ch 13, 21

### **Bacteriophages**

#### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. *Environmental Microbiology*. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. ch 20.2.2, 466- 468, 23.8, 599
- Jones, JB. et al. 2012. Consideration for using Bacteriophages for plant disease control. *Bacteriophage* 2:4, 208–214, doi.org/10.4161/bact.23857

#### **Recommended literature:**

- Goodridge, LD. 2004. Bacteriophage biocontrol of plant pathogens: fact or fiction. *Trends in biotechnology*. 22, 8. doi:doi:10.1016/j.tibtech.2004.05.007

## **Horticultural water**

### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3; chapters 22-23, 25-29.
- EUROPEAN UNION 2017 . Commission notice on guidance document on addressing microbiological risks in fresh fruits and vegetables at primary production through good hygiene. *Official Journal of the European Union*, 60, C163.
- PACHEPSKY, Y ., SHELTON, D. R., MACLAIN, J. E. T., PATEL, J. & MANDRELL, R. E. 2011. Irrigation waters as a source of pathogenic microorganisms in produce: a review. *Advances in Agronomy*, 113, 75-141.

### **Recommended literature:**

- DORAIS, M., ALSANIUS, B. W., VOOGT, W., PÉPIN, S., TÜZEL, H., TÜZEL, Y. & MÖLLER, K. 2016. *Impact of water quality and irrigation management on organic greenhouse horticulture*, Wageningen, [www.biogreenhouse.org](http://www.biogreenhouse.org).
- EHRET , D. L., ALSANIUS, B. W., WOHANKA, W., MENZIES, J. M. & UTKHEDE, R. S. 2001. Desinfestation of recirculating nutrient systems. *Agronomie*, 21, 323-339.

## **Week 5**

No assigned literature.

## **Week 6**

No assigned literature.

## **Week 7**

## **Bioremediation**

### **Mandatory literature:**

- Pepper IL, Gerba CP, Gentry TJ. 2015. Environmental Microbiology. 3rd ed., Academic Press; ISBN: 978-0-12-394626-3. Chapters 17-18.

## **Mushroom production**

### **Mandatory literature:**

- SANCHEZ, C. 2010. Cultivation of *Pleurotus ostratus* and other edible mushrooms. *Applied Microbiology and Biotechnology* 85, 1321–1337.
- BEYER , D.M. 2003. Basic procedures for *Agaricus* mushroom growing. *Penn State's College of Agricultural Sciences, USA*.
- GRIMM , D., Wösten, H.A.B. 2018. Mushroom cultivation in the circular economy. *Applied Microbiology and Biotechnology* <https://doi.org/10.1007/s00253-018-9226-8>

## **Biological control**

### Mandatory literature:

- NEGA A. 2014 . Review on Concepts in Biological Control of Plant Pathogens. *Journal of Biology, Agriculture and Healthcare* 4:27, 33-55.

## **Light interactions**

### Mandatory literature:

- van der Horst, M. A.; Key, J.; Hellingwerff, K. J., Photosensing in chemotrophic, nonphototrophic bacteria: let there be light sensing too. *Trends in Microbiology* 2007, 15 (12), 554-562.

## **Week 8**

### **Harvest and postharvest handling**

#### Mandatory literature:

- MOGREN, L., WINDSTAM, S., BOQVIST, S., VÅGSHOLM, I., SÖDERQVIST, K., ROSBERG, A. K., LINDÉN, J., MULAOSMANOVIC, E., KARLSSON, M. E., UHLIG, E., HÅKANSSON, Å. & ALSANIUS, B. W. 2018. The Hurdle Approach—A Holistic Concept for Controlling Food Safety Risks Associated With Pathogenic Bacterial Contamination of Leafy Green Vegetables. A Review. *Frontiers Microbiology*, 9, 1965.

### **Food safety**

#### Mandatory literature:

- MOGREN, L., WINDSTAM, S., BOQVIST, S., VÅGSHOLM, I., SÖDERQVIST, K., ROSBERG, A. K., LINDÉN, J., MULAOSMANOVIC, E., KARLSSON, M. E., UHLIG, E., HÅKANSSON, Å. & ALSANIUS, B. W. 2018. The Hurdle Approach—A Holistic Concept for Controlling Food Safety Risks Associated With Pathogenic Bacterial Contamination of Leafy Green Vegetables. A Review. *Frontiers Microbiology*, 9, 1965.
- EUROPEAN UNION 2017. Commission notice on guidance document on addressing microbiological risks in fresh fruits and vegetables at primary production through good hygiene. *Official Journal of the European Union*, 60, C163.

## **Consumer demands and quality of horticultural produce from a microbial perspective**

### **Mandatory literature:**

- Frewer, L. , Fischer, A., Scholderer, J & Verbeke, W. 2005. Food safety and consumer behaviour. In: Jongen, W.M.F. & Meulenberg, M.T.G. (eds.) Innovation in Agri-Food systems: Product quality and consumer acceptance. Wageningen Academic Publishers, Wageningen. pp 125-145.
- Grunert, K.G. 2005. Food quality and safety: consumer perception and demand. *European Review of Agricultural Economics* 32(3): 369-391.
- Kher, S. V. , De Jonge, J. , Wentholt, M. T., Deliza, R. , de Andrade, J. C., Clossen, H. J., Luijckx, N. B. and Frewer, L. J. 2013. Consumer perceptions of risks of chemical and microbiological contaminants associated with food chains: a cross-national study. *International Journal of Consumer Studies*, 37: 73-83.

### **Microbiota: the food-consumer interface**

No assigned literature.

### **Probiotics**

No assigned literature.

### **Risk assessment**

#### **Mandatory literature:**

- CAC/GL. 1999. PRINCIPLES AND GUIDELINES FOR THE CONDUCT OF MICROBIOLOGICAL RISK SSESSMENT. CAC/GL – 30, 1-6.
- CAC/GL. 2007. PRINCIPLES AND GUIDELINES FOR THE CONDUCT OF MICROBIOLOGICAL RISK MANAGEMENT (MRM). CAC/GL 63-2007, 1-19.