Syllabus- PLP6262 Fungal Plant Pathogens/PLP4260 Introduction to Plant Pathogenic Fungi
Spring 2021

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Class Location: 2306 Fifield Hall and online via Zoom
https://ufl.zoom.us/j/97977735639?pwd=RDh6ZDVySEFKU0xaL3d3akJZbzVmQT09

Class Times: 7 week module : Jan 11 to March 3, 2021
Lectures: MF period 5 (11:45-12:35 pm); W period 5-6 (11:45- 1:40 pm)
Labs: TR period 5-6 (11:45- 1:40 pm)

Class Website: http://elearning.ufl.edu/ (e-Learning in Canvas)
Office Hours: By appointment via Zoom
Class Recordings: https://mediasite.video.ufl.edu/Mediasite/Channel/plp6262-spring-2021

Course Description: This course is an introduction to the biology and diversity of fungal plant pathogens. Fungi and their allies are a diverse group of organisms that comprise the majority of plant pathogens. Their members are found in every fungal order, as well as among numerous orders outside the Kingdom Fungi but traditionally studied as fungi, e.g., the Stramenopiles. This course will include a survey of taxonomic groups of fungal and fungal-like plant pathogens, an overview of common fungal pathogens in various types of plant culture systems, and discussion of general plant pathology principles as they relate to fungal pathogens. Lectures and labs are co-taught with PLP4260C: Introduction to Plant Pathogenic Fungi. Students enrolled in the graduate course will have a course project and more rigorous Exams and Quizzes relative to their undergraduate classmates.

Course Objectives: Students will learn to

- distinguish among taxonomic orders that contain fungal pathogens, and identify fungal pathogens to order and genus level;
- recognize several of the most common fungal plant pathogens and understand key aspects of their biology and lifecycles that distinguish them;
- differentiate patterns in disease development and control strategies as they pertain to specific growing systems;
- use knowledge of pathogen biology and epidemiology to develop reasonable hypotheses about effective long and short term control strategies for fungal pathogens.

Course Texts:
Recommended: **Plant Pathology 5th Edition** (2005) by G. N. Agrios, Elsevier Academic Press, Inc.;
Mycology Guide: Key Terms and Concepts, **2nd Edition**, by N. Vargas et al., APS Press
Required: Journal articles will be assigned throughout the course. These will be made available through the class website. **A Reading List is attached.**

Exams and Grading: There will be three, non-cumulative lecture-lab-discussion exams. There will also be regular lab assignments, five short quizzes throughout the term, and a Fungal Biology Oral Presentation (PLP6262 only).

Quizzes: Quizzes will be unannounced, and will be given at the beginning of class or lab periods. They will be **open-book**, but students will have a limited time to complete the questions. If you arrive late, you will not be given additional time to complete the quiz, nor will make-up quizzes be given for unexcused

absences. Quiz questions will come from recent lectures or assigned readings, and will be designed to reinforce key concepts and help prepare you for questions that will appear on the exams.

Fungal Biology Presentation: Each PLP6262 student will develop and present a PowerPoint talk on a topic of fungal biology. Additional information concerning project requirements and due dates can be found on page 5.

Course Grade

Your course grade will be based on the following assessments:

Assessment	Points
Exam I	100
Exam II	100
Exam III	100
Quizzes	50
Lab Assignments	50
Oral Presentation*	50
Total Possible Points	**450**

*PLP6262 only

Your course grade will be assigned as follows.

Letter Grade	Grade Points	Percentage	Assignment Points
A	4.0	90 or above	≥405
A-	3.67	87-89.9	392-404
B+	3.33	84-86.9	378-391
B	3.0	80-83.9	360-377
B-	2.67	77-79.9	347-359
C+	2.33	74-76.9	333-346
C	2.0	70-73.9	315-332
C-	1.67	67-69.9	302-314
D+	1.33	64-66.9	288-301
D	1.0	60-63.9	270-287
D-	0.67	57-59.9	257-269
E	0.0	56.9 or below	≤256

Class Attendance & Participation: Participation is a vital part of both the course experience and the course grade. Students will be expected to arrive at each class on time and prepared to fully participate in the lecture, lab, or other class activities. If you must miss a class due to illness or other extenuating circumstances, notify the instructor as soon as possible. Student athletes will be excused for official events through the University Athletic Association. Absences due to personal planning (leaving town, attending club functions, picking someone up at the airport, etc.) will not be excused, and missed points may not be made up.

Make-up Work: If you are ill on an exam day, notify the instructor as soon as you are able, and a make-up exam will be scheduled for you. If you must miss an exam for any other reason, please make arrangements ahead of time to reschedule. In most cases, **laboratory exercises may not be made up**. Laboratory cultures, demonstrations, and other materials are typically prepared in advance, often ephemeral or expendable by nature, and cannot be easily recreated. If you absolutely must miss a lab, it is particularly important to notify the instructor before the end of the missed lab period, so that at least some of the demonstration materials may be set aside for you to view and work on later.

UNIVERSITY POLICIES AND SERVICES

Grades and Grade Points

For information on current UF policies for assigning grade points, see https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

Academic Honesty

In 1995 the UF student body enacted an honor code and voluntarily committed itself to the highest standards of honesty and integrity. When students enroll at the university, they commit themselves to the standard drafted and enacted by students.

The Honor Pledge: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.On all work submitted for credit by students at the university, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

The Honor Code and Student Code of Conduct specifies a number of behaviors that are in violation of this code and the possible sanctions. Click here to see the process for resolving reports of Honor Code violations. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel including the instructor, department chair, college dean, Student Honor Council, or Student Conduct and Conflict Resolution in the Dean of Students Office. If you have any questions or concerns, please consult with the instructor for this class.

It is assumed all work will be completed independently unless the assignment is defined as a group project, in writing by the instructor. This policy will be vigorously upheld at all times in this course.

Software Use:

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575,* **www.counseling.ufl.edu/cwc/**
  - Counseling Services
  - Groups and Workshops
  - Outreach and Consultation
  - Self-Help Library
  - Training Programs
  - Community Provider Database

- *Career Resource Center,* First Floor JWRU, 392-1601, **www.crc.ufl.edu/**

Services for Students with Disabilities

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center. Click here to get started with the Disability Resource Center. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Online course evaluation process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Click here for guidance on how to give feedback in a professional and respectful manner. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via ufl.bluera.com/ufl/.

COVID related practices

We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

- You are required to wear approved face coverings at all times during class and within buildings. Following and enforcing these policies and requirements are all of our responsibility. Failure to do so will lead to a report to the Office of Student Conduct and Conflict Resolution.
- This course has been assigned a physical classroom with enough capacity to maintain physical distancing (6 feet between individuals) requirements. Please utilize designated seats and maintain appropriate spacing between students. Please do not move desks or stations.
- Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
- Follow your instructor's guidance on how to enter and exit the classroom. Practice physical distancing to the extent possible when entering and exiting the classroom.
- If you are experiencing COVID-19 symptoms (Click here for guidance from the CDC on symptoms of coronavirus), please use the UF Health screening system and follow the instructions on whether you are able to attend class. Click here for UF Health guidance on what to do if you have been exposed to or are experiencing Covid-19 symptoms.
    - Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. Find more information in the university attendance policies.

Privacy-related issues

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

THE INSTRUCTOR RESERVES THE RIGHT TO CHANGE OR MODIFY INFORMATION PROVIDED IN THE SYLLABUS. CLASS ANNOUNCEMENTS SUPERSEDE SYLLABUS STATEMENTS.

Fungal Biology Oral Presentation Information

Topic Selection

Each student will develop and present a **20 min oral presentation** on a fungal biology topic. Topics may be chosen from the spreadsheet list found on the class website or a topic of your own choosing with approval from the instructor. Topics will be claimed on a first-requested–first-assigned basis. You will sign up by e-mailing me directly (rollinsj@ufl.edu) with the topic that you have chosen. I will update and post the spreadsheet in the order that I receive the e-mail requests. I will send an e-mail confirmation when I have approved your choice. Once someone has signed up for a particular topic, no other student will be permitted to present on this topic. **A topic must be chosen by the end of lecture on February 1**. Sign up early if you have a topic you are particularly interested in! P**resentations will begin on February 18**. The order of presentations will be chosen at random.

Presentation Style and Length

Length: 20 min; an extra five minutes will be available for questions.

Format: PowerPoint

Organization: A title slide including the topic and your name is required. Background/introductory information is expected. A clear and concise explanation of the topic is expected. Examples of how the topic advances understanding of biology (fungal or otherwise) or is applied to managing disease, improving ecosystems, producing useful products, etc is expected. Presentation of information from a recently published paper concerning the topic may be helpful. A summary of key take away points should be obvious and emphasized.

Style: These presentations are intended to be mini topical lectures. Your audience is Graduate and Doctor of Plant Medicine students.

Exam question: Each presenter will create one multiple-choice question pertaining to his/her presentation topic. You should e-mail this question to me (rollinsj@ufl.edu) with the correct answer indicated after your presentation is given. The exam questions will be posted on the e-Learning (Canvas) course page.

Resources and References

Every source of data, pictures, text, information, etc. used in your presentation should be cited on the slide. If too many for each slide, include a reference list at the end.

Due Dates

A pdf or powerpoint copy of your presentation is due by the end of the class period on the day of your presentation. This copy can be directly e-mailed (rollinsj@ufl.edu) or cloud-dropped to the instructor.

Grading

Your presentation is worth 50 points. 20 points for structure (organization of slides and presentation, turned in on time, etc.), 25 points for accuracy of information, and 5 points for presentation style.

PLP6262 Fungal Plant Pathogens

Spring 2021

Course Schedule (Tentative)

Date	Day	#	Topic
Jan 11	M	Lecture 1	Ways of Being: Plant-Fungal Interactions • Mutualism-parasitism continuum • Mycorrhizae • Epiphytes & Endophytes • Biotrophs, hemibiotrophs, and necrotrophs
Jan 12	T	Lab 01 Demonstrations Discussion 1	Plant-Fungal Interactions • Endo- and Ecto-Mycorrhizae • Epiphytes and Endophytes • Discussion: Taylor, J.W., 2011. One Fungus = One Name: DNA and fungal nomenclature twenty years after PCR. IMA Fungus 2, 113–120. https://doi.org/10.5598/imafungus.2011.02.02.01 Kuo, H.-C., Hui, S., Choi, J., Asiegbu, F.O., Valkonen, J.P.T., Lee, Y.-H., 2014. Secret lifestyles of *Neurospora crassa*. Sci. Rep. 4. https://doi.org/10.1038/srep05135
Jan 13	W	Lecture 2 & Discussion Syllabus	Adaptations for Pathogenicity • Obligate vs. opportunistic pathogens • Pathogenicity factors • Syllabus Review and Discussion
Jan 14	Th	Lab 02 Demonstrations Discussion 3	Isolating fungi from plant material • Techniques • Selective media Tanaka, T., Kawasaki, K., Daimon, S., Kitagawa, W., Yamamoto, K., Tamaki, H., Tanaka, M., Nakatsu, C.H., Kamagata, Y., 2014. A Hidden Pitfall in the Preparation of Agar Media Undermines Microorganism Cultivability. Appl. Environ. Microbiol. 80, 7659–7666. https://doi.org/10.1128/AEM.02741-14
Jan 15	F	Lecture 3	Groups of Fungal Pathogens • Review of fungal orders & Stramenopiles • Taxonomic vs. functional groups
Jan 18	M	HOLIDAY	HOLIDAY
Jan 19	T	Lab 03 Demonstrations Discussion 3	Isolation and maintenance of fungal cultures • Types and purposes of various fungal storage methods Elliott, M.L., 2005. Survival, growth and pathogenicity of *Gaeumannomyces graminis* var. *graminis* with different methods of long-term storage. Mycologia 97, 901–907. https://doi.org/10.3852/mycologia.97.4.901
Jan 20	W	Lecture 4 & Discussion	Stramenopiles: Taxonomy, Biology, and Ecology
Jan 21	Th	Lab 04	Stramenopile pathogens: the Oomycetes • *Pythium* vs. *Phytophthora* • Downy mildews
Jan 22	F	Lecture 5	Chytrids: Taxonomy, Biology, and Ecology

			• Chytrid pathogens & pathogen vectors • Chytrid mycoparasites
Jan 25	M	Lecture 6	Mucoromycota: Taxonomy, Biology, and Ecology
Jan 26	T	Lab 05	Chytrid & Mucormycota pathogens • Chytrids in natural, agricultural, and landscape settings • Mucormycetes: field and postharvest rotters
Jan 27	W	Review	Exam Review
Jan 28	Th	**Exam**	Exam I
Jan 29	F	Lecture 7	Ascomycota: Taxonomy, Biology, and Ecology
Feb 1	M	Lecture 7 cont.	Ascomycota: Taxonomy, Biology, and Ecology continued
Feb 2	T	Lab 06	Ascomycota pathogens • Structures & Functions Recognizing an Ascomycete
Feb 3	W	Lecture 8 & Discussion	Basidiomycota: Taxonomy, Biology, and Ecology
Feb 4	Th	Lab 07	Ascomycete pathogens, cont. • Sexual and asexual ascomycetes • Conidial structures and identification
Feb 5	F	Lecture 9	Fungal Disease Cycles and Epidemiology • Disease progress curves • Polycyclic vs. Monocyclic diseases Inoculum density and inoculum potential
Feb 8	M	Lecture 10	Fungi in the Air: Airborne pathogens and Foliar diseases
Feb 9	T	Lab 08	Basidiomycete pathogens • Structures & functions • Recognizing a Basidiomycete
Feb 10	W	Lecture 11 & Discussion	Soilborne Fungal Pathogens
Feb 11	Th	Lab 09	Work on oral presentations
Feb 12	F	Lecture 12	Fungal Pathogens in Row Crops vs. Perennial Crops
Feb 15	M	Review	
Feb 16	T	Exam	Exam II
Feb 17	W	Lecture 13	Diseases in Perennial Crops
Feb 18	Th	Presentations	Presentations 1-5
Feb 19	F	Lecture 14	Forest Pathology & Pathogen Ecology
Feb 22	M	Lecture 15	Diseases in Ornamental Plants
Feb 23	T	Presentations	Presentations 6-10
Feb 24	W	Lecture 16	Control of Fungal Diseases • Whetzel's principles of plant disease control • Cultural controls
Feb 25	Th	Presentations	Presentations 11-15
Feb 26	F	Lecture 17	Chemical Control of Fungal Diseases • Classes of chemicals and their modes of action • Chemical Resistance
Mar 1	M	Review	Exam Review
Mar 3	W	Exam	Exam III

Reading List for PLP6905 (6262) (tentative, subject to change)

***these papers marked with an '*' are required reading and will be discussed during lab periods as indicated on the schedule**

Lecture #	Reading
01	Bidartondo, Dawn of symbiosis between plants and fungi.pdf
01	Johnson, Functioning of mycorrhizal associations along the mutualism-parasitism continuum.pdf
01	Redman, Fungal Symbiosis from mutualism to parasitism.pdf
01*	Kuo, Secret lifestyles of Neurospora crassa.pdf
01*	Taylor, One Fungus = One Name.pdf
02*	Tanaka, Agar Media.pdf
02	DeZwaan, Magnaporthe grisea pth11p.pdf
02	Jaroszuk-Scisel, Activities of CWDE.pdf
02	Thomma, Alternaria saprophyte to parasite.pdf
02	Schafer, One enzyme makes a fungal pathogen.pdf
03	Rossman, Systematics of Plant Pathogenic Fungi.pdf
03	Hawksworth, The Amsterdam Declaration on Fungal Nomenclature.pdf
03	Crous, Identifying and Naming Plant-Pathogenic Fungi_Past, Present, and Future.pdf
03*	Elliott, Methods of long-term storage.pdf
04	Beakes, Evolutionary phylogeny of oomycetes.pdf
04	Ivors, Microsatellite markers identify lineages of P. ramorum.pdf
04	Kroon, Genus Phytophthora Anno 2012.pdf
04	Nelson, Rhizosphere regulation of oomycete pathogens.pdf
04	vanWest, Oomycete Plant Pathogens use Electric Fields.pdf
05	Hwang, Plasmodiophora brassicae review.pdf
05	Kanyuka, Polymyxa_graminis.pdf
05	Fry, Transmission of TNV by Olpidium.pdf
06	Hanson, Interaction of Rhizoctonia & Rhizopus.pdf
06	Holmes, Influence of wound type on Rhizopus soft rot.pdf
06	Partida-Martinez, Pathogenic fungus harbours endosymbiotic bacteria.pdf
06	Spatafora, Phylogenetic classification of zygomycete.pdf
07	Schoch, Ascomycota tree of life.pdf
08	Binder and Hibbett, Boletales.pdf
08	Lutz&Baur, Double Life of a Fungus.pdf
09	Scott, Spatiotemporal analysis of epiphytotics of downy mildew.pdf
09	Beltran, Epidemiology of Monosporascus root rot.pdf
09	Montes-Borrego, Role of oospores as primary inoculum.pdf
10	Noblin, Surface tension propulsion of fungal spores.pdf
10	Paul, Rain splash dispersal of Gibberella.pdf
10	Stolze-Rybczynski, Adaptation of spore discharge in basidiomycota.pdf
10	Trail, Fungal cannons- explosive spore discharge in ascomycota.pdf
11	Allen&Newhook, Chemotaxis of zoospores to ethanol in capillaries.pdf
11	Dobbs&Gash, Microbial and Residual Mycostasis.pdf
11	Duniway, Movement of Zoospores of Phytophthora in soils.pdf
11	Garcia-Garza, Fusox spore movement through soil.pdf
11	MacDonald&Duniway, Influence of soil texture and temp on motility of Phytophthora.pdf
11	Subbarao, Effects of Deep Plowing on Scleroninia minor.pdf
14	Newhouse et al. - 2014 - Transgenic American chestnuts show enhanced blight.pdf
14	Multigene phylogeny of filamentous ambrosia fungi associated with ambrosia and bark beetles.pdf

Full bibliography of Reading List articles

Massoumi Alamouti, S., Tsui, C. K. M., and Breuil, C. 2009. Multigene phylogeny of filamentous ambrosia fungi associated with ambrosia and bark beetles. Mycol. Res. 113:822–835.

Allen, R.N., and F.J. Newhook. 1973. Chemotaxis of zoospores of *Phytophthora cinnamomi* to ethanol in capillaries of soil pore dimensions. *Transactions of the British Mycological Society*. 61:287–IN12.

Beakes, G.W., and S. Sekimoto. 2008. The Evolutionary Phylogeny of Oomycetes—Insights Gained from Studies of Holocarpic Parasites of Algae and Invertebrates. *In* Oomycete Genetics and Genomics: Diversity, Interactions, and Research Tools. K. Lamour and S. Kamoun, editors. John Wiley & Sons, Inc. 1–24.

Beltrán, R., A. Vicent, J. García-Jiménez, and J. Armengol. 2008. Comparative Epidemiology of *Monosporascus* Root Rot and Vine Decline in Muskmelon, Watermelon, and Grafted Watermelon Crops. *Plant Disease*. 92:158–163.

Bidartondo, M.I., D.J. Read, J.M. Trappe, V. Merckx, R. Ligrone, and J.G. Duckett. 2011. The Dawn of Symbiosis Between Plants and Fungi. *Biol. Lett.* 7:574–577.

Crous, P.W., D.L. Hawksworth, and M.J. Wingfield. 2015. Identifying and Naming Plant-Pathogenic Fungi: Past, Present, and Future. *Annual Review of Phytopathology*. 53:247–267.

DeZwaan, T.M., A.M. Carroll, B. Valent, and J.A. Sweigard. 1999. *Magnaporthe grisea* pth11p is a novel plasma membrane protein that mediates appressorium differentiation in response to inductive substrate cues. *Plant Cell*. 11:2013–2030.

Dobbs, C.G., and M.J. Gash. 1965. Microbial and Residual Mycostasis in Soils. *, Published online: 25 September 1965; | doi:10.1038/2071354a0*. 207:1354–1356.

Duniway, J.M. 1976. Movement of Zoospores of *Phytophthora cryptogea* in Soils of Various Textures and Matric Potentials. *Phytopathology*. 66:877.

Elliott, M.L. 2005. Survival, growth and pathogenicity of *Gaeumannomyces graminis* var. *graminis* with different methods of long-term storage. Mycologia 97, 901–907. https://doi.org/10.3852/mycologia.97.4.901

Fry, P.R., and R.N. Campbell. 1966. Transmission of a tobacco necrosis virus by *Olpidium brassicae*. *Virology*. 30:517–527.

Gracia-Garza, J.A., and D.R. Fravel. 1998. Effect of Relative Humidity on Sporulation of *Fusarium oxysporum* in Various Formulations and Effect of Water on Spore Movement Through Soil. *Phytopathology*. 88:544–549.

Hanson, L.E. 2010. Interaction of *Rhizoctonia solani* and *Rhizopus stolonifer* Causing Root Rot of Sugar Beet. *Plant Disease*. 94:504–509.

Hawksworth, D.L., P.W. Crous, S.A. Redhead, et al. 2011. The Amsterdam Declaration on Fungal Nomenclature. *IMA Fungus*. 2:105–112.

Holmes, G.J., and R.R. Stange. 2002. Influence of Wound Type and Storage Duration on Susceptibility of Sweetpotatoes to *Rhizopus* Soft Rot. *Plant Disease*. 86:345–348.

Hwang, S.-F., S.E. Strelkov, J. Feng, B.D. Gossen, and R.J. Howard. 2011. *Plasmodiophora brassicae*: a review of an emerging pathogen of the Canadian canola (Brassica napus) crop. *Molecular Plant Pathology*. 13:105–113.

Ivors, K., M. Garbelotto, I.D.E. Vries, C. Ruyter-Spira, B. Te Hekkert, N. Rosenzweig, and P. Bonants. 2006. Microsatellite markers identify three lineages of *Phytophthora ramorum* in US nurseries, yet single lineages in US forest and European nursery populations. *Mol. Ecol.* 15:1493–1505.

Jaroszuk-Scisel, J., E. Kurek, A. Slomka, M. Janczarek, and B. Rodzik. 2011. Activities of cell wall degrading enzymes in autolyzing cultures of three *Fusarium culmorum* isolates: growth-promoting, deleterious and pathogenic to rye (*Secale cereale*). *Mycologia*. 103:929–945.

Johnson, N.C., J.-H. Graham, and F.A. Smith. 2008. Functioning of mycorrhizal associations along the mutualism–parasitism continuum. *New Phytologist*. 135:575–585.

Kanyuka, K., E. Ward, and M.J. Adams. 2003. *Polymyxa graminis* and the cereal viruses it transmits: a research challenge. *Molecular Plant Pathology*. 4:393–406.

Kroon, L.P.N.M., H. Brouwer, A.W.A.M. de Cock, and F. Govers. 2012. The genus *Phytophthora* anno 2012. *Phytopathology*. 102:348–364.

Kuo, H.-C., Hui, S., Choi, J., Asiegbu, F. O., Valkonen, J. P. T., and Lee, Y.-H. 2014. Secret lifestyles of Neurospora crassa. Sci. Rep. 4:1-6. https://doi.org/10.1038/srep05135

Kv, S., K. St, and H. Jc. 1996. Effects of deep plowing on the distribution and density of Sclerotinia *minor* sclerotia and lettuce drop incidence. *Plant disease*. 80:28.

Lutz, M., R. Bauer, and F. Oberwinkler. 2007. The Double Life of a Fungus. *German Research*. 29:21–23.

MacDonald, J.D. 1978. Influence of soil texture and temperature on the motility of *Phytophthora cryptogea* and *P. megasperma* Zoospores. *Phytopathology*. 68:1627.

Montes-Borrego, M., B.B. Landa, J.A. Navas-Cortés, F.J. Muñoz-Ledesma, and R.M. Jiménez-Díaz. 2009. Role of oospores as primary inoculum for epidemics of downy mildew caused by *Peronospora arborescens* in opium poppy crops in Spain. *Plant Pathology*. 58:1092–1103.

Nelson, E.B. Rhizosphere Regulation of Preinfection Behavior of Oomycete Plant Pathogens. *In* Microbial Activity in the Rhizoshere. K.G. Mukerji, C. Manoharachary, and J. Singh, editors. Springer-Verlag, Berlin/Heidelberg. 311–343.

Newhouse, A. E., Polin-McGuigan, L. D., Baier, K. A., Valletta, K. E. R., Rottmann, W. H., Tschaplinski, T. J., et al. 2014. Transgenic American chestnuts show enhanced blight resistance and transmit the trait to T1 progeny. Plant Science. 228:88–97.

Noblin, X., S. Yang, and J. Dumais. 2009. Surface Tension Propulsion of Fungal Spores. *J Exp Biol*. 212:2835–2843.

Partida-Martinez, L.P., and C. Hertweck. 2005. Pathogenic fungus harbours endosymbiotic bacteria for toxin production. *Nature*. 437:884–888.

Paul, P.A., S.M. El-Allaf, P.E. Lipps, and L.V. Madden. 2004. Rain Splash Dispersal of *Gibberella zeae* Within Wheat Canopies in Ohio. *Phytopathology*. 94:1342–1349.

Redman, R.S., D.D. Dunigan, and R.J. Rodriguez. 2001. Fungal symbiosis from mutualism to parasitism: who controls the outcome, host or invader? *New Phytologist*. 151:705–716.

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