

# THE AMERICAN PHYTOPATHOLOGICAL SOCIETY

Founded 1908

Incorporated 1915

## The APS Council

President, PAUL H. WILLIAMS, University of Wisconsin, Madison 53706  
President-Elect, GEORGE N. AGRIOS, University of Florida, Gainesville 32611  
Vice-President, O. W. BARNETT, Clemson University, Clemson, SC 29631  
Immediate Past President, DON E. MATHRE, Montana State University, Bozeman 59717  
Secretary, MOLLY N. CLINE, Monsanto Agricultural Co., St. Louis, MO 63167  
Treasurer, DAVID W. FRENCH, University of Minnesota, St. Paul 55108  
Editor-in-Chief, APS Press, RICHARD W. SMILEY, Oregon State University, Pendleton 97801  
Editor-in-Chief, PHYTOPATHOLOGY, D. MICHAEL BENSON, North Carolina State University, Raleigh 27695  
Editor-in-Chief, PLANT DISEASE, WAYNE A. SINCLAIR, Cornell University, Ithaca, NY 14853-5908  
Editor-in-Chief, MOLECULAR PLANT-MICROBE INTERACTIONS, LUIS SEQUEIRA, University of Wisconsin, Madison 53706

## Councilors:

RANDALL C. ROWE, Ohio State University, Wooster 44691 (At Large)  
CLEORA J. D'ARCY, University of Illinois, Urbana 61801 (At Large)  
SUE A. TOLIN, Virginia Polytechnic Institute and State University, Blacksburg 24061 (At Large)  
JOSE AMADOR, Texas Agricultural Extension Service, Weslaco 78596 (Caribbean)  
MEL LACY, Michigan State University, East Lansing 48823 (North Central)  
STANLEY PENNYPACKER, Pennsylvania State University, University Park 16802 (Northeastern)  
MARY POWELSON, Oregon State University, Corvallis 97331 (Pacific)  
WILLIAM L. MacDONALD, West Virginia University, Morgantown 26506-6057 (Potomac)  
KENNETH E. CONWAY, Oklahoma State University, Stillwater 74078-0285 (Southern)

## Staff:

R. J. TARLETON, Executive Vice-President; STEVEN C. NELSON, Associate Executive Vice President; LARRY HARTMAN, Director of Finance and Administration; The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121

## Divisions of the Society

**Caribbean:** President, JORGE VICTORIA, Cenicafía, Cali, Colombia; Vice-President, JULIA S. MIGNUCCI, University of Puerto Rico, Mayaguez, Puerto Rico; Secretary-Treasurer, JOSE J. GALINDO, CATIE, Turrialba, Costa Rica  
**North Central:** President, CHRISTINE STEPHENS, Michigan State University, East Lansing 48824; Vice-President, EINAR W. PALM, University of Missouri, Columbia 65211; Secretary-Treasurer, CAROL E. WINDELS, University of Minnesota, N.W. Experiment Station, Crookston 56716  
**Northeastern:** President, DALE BERGDAHL, University of Vermont, Burlington 05405; Vice-President, STEPHEN JOHNSTON, Rutgers R & D Center, Bridgeton, NJ 08302; Secretary-Treasurer, DAVID PIECZARKA, Agway, Inc.-R & D, Syracuse, NY 13221  
**Pacific:** President, MIKE STANGHELLINI, University of Arizona, Tucson 85721; Vice-President, FRED GRAY, University of Wyoming, University Station, WY 82071; Secretary-Treasurer, JAMES MacDONALD, University of California, Davis 95616  
**Potomac:** President, ROBERT B. CARROLL, University of Delaware, Newark 19717-1303; Vice-President, GEORGE A. BEAN, University of Maryland, College Park 20742; Secretary-Treasurer, SUZANNE HURTT, USDA-ARS, PGGI, Glenn Dale, MD 20769  
**Southern:** President, CLAUDE E. THOMAS, USDA-ARS Vegetable Lab, Charleston, SC 29407; Vice-President, C. LEE CAMPBELL, North Carolina State University, Raleigh 27695; Secretary-Treasurer, JOHN C. RUPE, University of Arkansas, Fayetteville

## Editorial and Business Staff

Publisher and Business Manager, R. J. TARLETON; Graphic Services Manager, STEVE KRONMILLER; Senior Technical Editor, VERA BAKER; Technical Editor, JEAN RICE; Editorial Assistant, SUSAN CASEY; Editorial Records Coordinator, JANICE SAMPSON

**Subscriptions:** Communications should be addressed to The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121.

**Nonmember subscription price:** \$185.00 per year domestic, \$220.00 per year elsewhere (including Canada and Mexico). All prices include surface postage. For expedited mail, add \$25.00 to the "elsewhere" price. All payments must be made in U.S. funds, through a member bank of the U.S. Federal Reserve System. **Single current numbers** (within 60 days of publication): \$16.00. (Price of back volumes and separate numbers on request.) **Airmail rates for delivery outside of North America quoted on request.** Claims for copies lost in domestic mails must be received within 60 days of the date of issue; otherwise the replacement charge will be \$16.00. Deliveries overseas are not guaranteed; foreign mailings are made at the subscriber's risk. No endorsement or any statement of claims made in advertisements is assumed by this journal or by The American Phytopathological Society.

**Membership in The American Phytopathological Society:** Information concerning membership in The American Phytopathological Society and special publication rates for members are available from the business office of the Society.

Published monthly at The American Phytopathological Society  
3340 Pilot Knob Road, St. Paul, MN 55121  
(612) 454-7250

Second class postage paid at St. Paul, MN. PUB 431540

# Phytopathology

## Editorial Board

### Editor-in-Chief:

D. M. BENSON, North Carolina State University, Raleigh 27695-7616

### Senior Editors:

T. W. CARROLL, Montana State University, Bozeman 59717  
J. V. GROTH, University of Minnesota, St. Paul 55108  
L. V. MADDEN, Ohio State University, Wooster 44691  
M. L. POWELSON, Oregon State University, Corvallis 97331  
S. G. PUEPPKE, University of Missouri, Columbia 65211  
E. G. RUPPEL, Colorado State University, Fort Collins 80526

### Associate Editors

A. R. BIGGS, Agriculture Canada Research Station, Vineland Station, Ontario L0R 2E0 Canada  
R. M. BOSTOCK, University of California, Davis 95616  
M. L. CARSON, South Dakota State University, Brookings 57007  
B. M. CUNFER, Georgia Experiment Station, Experiment 30212  
M. E. DAUB, North Carolina State University, Raleigh 27695  
R. E. DAVIS, USDA-ARS, Beltsville, MD 20705  
T. P. DENNY, University of Georgia, Athens 30602  
L. J. FRANCL, USDA-ARS, Beltsville, MD 20705  
D. R. FRAVEL, USDA-ARS, Beltsville, MD 20705  
R. D. GITAITIS, Coastal Plain Experiment Station, Tifton, GA 31793  
T. R. GOTTWALD, USDA-ARS, Orlando, FL 32803  
N. C. GUDMESTAD, North Dakota State University, Fargo 58105  
M. HAWES, University of Arizona, Tucson 85721  
L. J. HERR, Ohio State University, Wooster 44691  
C. HIRUKI, University of Alberta, Edmonton, Alberta, Canada T6G 2P5  
H.-T. HSU, USDA-ARS, Beltsville, MD 20705  
K. B. JOHNSON, Oregon State University, Corvallis 97331  
D. K. KLUEPFEL, Clemson University, Clemson, SC 29631  
J. F. LESLIE, Kansas State University, Manhattan 66506  
S. A. LOMMEL, North Carolina State University, Raleigh 27695-7616  
D. S. MARSHALL, Texas A&M University Center, Dallas 75252-6599  
S. R. SHAFER, North Carolina State University, Raleigh 27695-7616  
H. D. SHEW, North Carolina State University, Raleigh 27695-7616  
R. P. SINGH, Agriculture Canada, Fredrickton, New Brunswick E3B 4Z7  
D. A. SMITH, University of Kentucky, Lexington 40546-0091  
R. A. SPOTTS, Mid-Columbia Agriculture Research and Experiment Center, Hood River, OR 97031  
B. J. STEFFENSON, North Dakota State University, Fargo 58105  
R. J. STIPES, Virginia Polytechnic Institute and State University, Blacksburg 24061  
P. W. TOOLEY, USDA-ARS, Frederick, MD 21701

### General Publication Policies

Manuscripts may be submitted for consideration of publication in PHYTOPATHOLOGY by members of The American Phytopathological Society and by nonmembers. Membership in the Society is not a prerequisite for publication in the journal, but page charges are higher for nonmembers than for members.

**Submission of manuscripts:** Submit all new manuscripts to The American Phytopathological Society, Editorial Office, 3340 Pilot Knob Road, St. Paul, MN 55121. Do not submit new manuscripts to the Editor-in-Chief. Submission implies nonsubmission elsewhere and (if accepted) no publication elsewhere in the same form without consent.

**Content:** Contributions should fall into the following categories: 1) Original research on some aspect of plant pathology. Subject matter is not a criterion for judging the merit of an article for publication in PHYTOPATHOLOGY. It is, however, the author's duty to establish relevancy to the science of plant pathology. 2) Review papers developing a new concept, hypothesis, theory, or other integration of plant pathology. 3) Letters to the Editor: These may explain, amplify, or otherwise comment upon research published in the journal or elsewhere. Letters to the editor are reviewed in the same manner as other contributions, and the Editorial Board reserves the right to reject or to publish letters of rebuttal when appropriate. If possible, the opportunity will be provided for a letter of rebuttal to appear in the same issue as the letter to which it is directed.

**Page charges:** Because of the high cost of publishing articles in PHYTOPATHOLOGY, payment of page charges is mandatory. Page charges are subject to change and will not be finalized until an author receives galley proofs. Current charges are \$90 per printed page for members of the Society and \$155 per printed page for nonmembers. Authors who submit manuscripts satisfactorily prepared for OCR-electronic processing will receive a decrease of \$25 per printed page. An author will be billed after the article is printed in the journal. **A letter confirming that the author or the author's institution, company, or research sponsor will honor the page charges must accompany each manuscript submitted.**

**Separates:** No free copies supplied. Reprints will be available at a nominal cost; an estimate will be sent with proof. Orders for reprints must be received within the year after publication of an article.

**For style details, follow:** Author's Guide for Manuscript Preparation, PHYTOPATHOLOGY 80:4-6, 1990. Authors are urged to have one or more colleagues read the manuscript *critically* prior to submission.

**Use of material from this journal:** PHYTOPATHOLOGY is copyrighted, and those who wish to use illustrations or data appearing in PHYTOPATHOLOGY in other publications should obtain the permission from The American Phytopathological Society and the author of the paper and provide a line crediting PHYTOPATHOLOGY as the source of the material.

Authorization to photocopy copyrighted material for internal or personal use, or the internal or personal use of specific clients, is granted by The American Phytopathological Society for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$3.00 per copy of an article is paid directly to CCC, 21 Congress St., Salem, MA 01970. 0031-949X/90 \$3.00 + .00