

# Appendix

## Microbes, Nematodes, and Pests Associated with *Allium* spp.

The microbes, nematodes, insects, and host plants listed below are reported to be associated with *Allium* spp. Not all are discussed in the text, and some names have been updated taxonomically and are noted as a synonym of the more recent name.

### Bacteria and Yeast

Scientific Name (* denotes the name is a synonym)	Common Name
<i>Bacillus cereus</i> Frankland & Frankland	soft rot
<i>Burkholderia cepacia</i> (Palleroni & Holmes ex Burkholder) Yabuuchi et al.	sour skin
<i>Burkholderia gladioli</i> (Severini) Yabuuchi et al. pv. <i>alliicola</i> (Burkholder) Young et al.	slippery skin
<i>Dickeya chrysanthemi</i> (Burkholder et al.) Samson et al.	soft rot
<i>Enterobacter cloacae</i> (Jordan) Hormaeche & Edwards	Enterobacter bulb decay
* <i>Erwinia carotovora</i> (Jones) Bergey et al. subsp. <i>carotovora</i> (Jones) Bergey et al.	soft rot
* <i>Erwinia chrysanthemi</i> Burkholder et al.	soft rot
* <i>Erwinia herbicola</i> (Lohnis) Dye	bacterial stalk and leaf necrosis
<i>Erwinia rhapontici</i> (Millard) Burkholder	soft rot
<i>Escherichia</i> sp.	soft rot
<i>Klebsiella</i> sp.	soft rot
<i>Kluyveromyces marxianus</i> (E. C. Hansen) van der Walt var. <i>marxianus</i> (E. C. Hansen) van der Walt	yeast soft rot
<i>Lactobacillus</i> sp.	soft rot
<i>Pantoea agglomerans</i> (Beijerinck) Gavini et al.	bacterial stalk and leaf necrosis
<i>Pantoea ananatis</i> (Serrano) Mergaert et al.	center rot
<i>Pectobacterium carotovorum</i> (Jones) Waldee subsp. <i>carotovorum</i> (Jones) Waldee emend. Hauben et al.	soft rot
<i>Pseudomonas aeruginosa</i> (Schroeter) Migula	brown rot
* <i>Pseudomonas cepacia</i> (Burkholder) Palleroni & Holmes	sour skin
* <i>Pseudomonas gladioli</i> Severini pv. <i>alliicola</i> (Burkholder) Young et al.	slippery skin
<i>Pseudomonas marginalis</i> (Brown) Stevens pv. <i>marginalis</i> (Brown) Stevens	soft rot
<i>Pseudomonas syringae</i> van Hall	bacterial leaf spot
<i>Pseudomonas viridiflava</i> (Burkholder) Dowson	leaf streak and bulb rot
<i>Serratia marcescens</i> Bizio	soft rot
<i>Xanthomonas axonopodis</i> Starr & Garces emend. Vauterin et al. pv. <i>allii</i> (Dowson) Roumagnac et al.	Xanthomonas leaf blight

### Fungi and Fungal-Like Organisms

Scientific Name	Common Name
<i>Athelia rolfsii</i> (Curzi) C. C. Tu & Kimbr.	southern blight
<i>Alternaria porri</i> (Ellis) Cif.	purple blotch
<i>Aspergillus niger</i> Tiegh.	black mold
* <i>Botryodiplodia theobromae</i> Pat.	Diplodia stain
<i>Botryotinia fuckeliana</i> (de Bary) Whetzel	brown stain
<i>Botryotinia porri</i> (J. F. H. van Beyma) Whetzel	Botrytis rot of garlic
<i>Botryotinia squamosa</i> Vienn.-Bourg.	Botrytis leaf blight

<i>Botrytis aclada</i> Fresen.	neck rot and scape blight
<i>Botrytis allii</i> Munn	neck rot and scape blight
<i>Botrytis byssoides</i> J. C. Walker	mycelial neck rot
<i>Botrytis cinerea</i> Pers.:Fr.	brown stain and scape blight
<i>Botrytis porri</i> N. F. Buchw.	Botrytis rot of garlic
<i>Botrytis squamosa</i> J. C. Walker	Botrytis leaf blight and scape blight
<i>Botrytis tulipae</i> (Lib.) Lind	Botrytis rot
* <i>Cephalosporium proliferatum</i> Matsush.	Fusarium bulb rot
<i>Cercospora duddiae</i> Welles	Cercospora leaf spot
<i>Cladosporium allii</i> (Ellis & G. W. Martin) P. M. Kirk & J. G. Crompton	leaf blotch
<i>Cladosporium allii-cepae</i> (Ranoj.) M. B. Ellis	leaf blotch
<i>Colletotrichum circinans</i> (Berk.) Voglino	smudge
* <i>Colletotrichum dematium</i> (Pers.:Fr.) Grove f. <i>circinans</i> (Berk.) Arx	smudge
<i>Colletotrichum gloeosporioides</i> (Penz.) Penz. & Sacc. in Penz.	twister
* <i>Diplodia natalensis</i> Pole-Evans	Diplodia stain
<i>Embellisia allii</i> (Campan.) E. G. Simmons	Embellisia skin blotch and bulb canker
<i>Fusarium culmorum</i> (Wm. G. Sm.) Sacc.	Fusarium basal rot
<i>Fusarium equiseti</i> (Corda) Sacc.	<i>Fusarium</i> diseases
* <i>Fusarium moniliforme</i> J. Sheld.	<i>Fusarium</i> diseases
<i>Fusarium oxysporum</i> Schltdl.:Fr.	<i>Fusarium</i> diseases
<i>Fusarium oxysporum</i> Schltdl.:Fr. f. sp. <i>cepae</i> (H. N. Hansen) W. C. Snyder & H. N. Hansen	Fusarium basal rot
<i>Fusarium proliferatum</i> (Matsush.) Nirenberg ex Gerlach & Nirenberg	Fusarium bulb rot
* <i>Fusarium roseum</i> Link emend. W. C. Snyder & H. N. Hansen var. <i>culmorum</i> (Schwabe) W. C. Snyder & H. N. Hansen	Fusarium basal rot
<i>Fusarium solani</i> (Mart.) Sacc.	<i>Fusarium</i> diseases
<i>Fusarium subglutinans</i> (Wollenw. & Reinking) P. E. Nelson et al.	<i>Fusarium</i> diseases
<i>Fusarium tricinctum</i> (Corda) Sacc.	<i>Fusarium</i> diseases
<i>Fusarium verticillioides</i> (Sacc.) Nirenberg	<i>Fusarium</i> diseases
<i>Gibberella fujikuroi</i> (Sawada) Ito in Ito & K. Kimura	<i>Fusarium</i> diseases
<i>Glomerella cingulata</i> (Stoneman) Spauld. & H. Schrenk	twister
* <i>Helminthosporium allii</i> Campan.	Embellisia skin blotch and bulb canker
* <i>Heterosporium allii</i> Ellis & G. W. Martin	leaf blotch
* <i>Heterosporium allii-cepae</i> Ranoj.	leaf blotch
<i>Lasioidiplodia theobromae</i> (Pat.) Griffon & Maubl.	Diplodia stain
<i>Leveillula taurica</i> (Lév.) G. Arnaud	powdery mildew
<i>Macrophomina phaseolina</i> (Tassi) Goid.	charcoal rot
<i>Mycosphaerella allii-cepae</i> M. M. Jord., Maude & Burchill	leaf blotch
<i>Oidiopsis sicula</i> Scalia	powdery mildew
<i>Penicillium aurantiogriseum</i> Dierckx	blue mold
<i>Penicillium citrinum</i> Thom	blue mold
* <i>Penicillium corymbiferum</i> Westling	Penicillium decay
* <i>Penicillium cyclopium</i> Westling	blue mold
<i>Penicillium digitatum</i> (Pers.:Fr.) Sacc.	blue mold
<i>Penicillium expansum</i> Link	blue mold
<i>Penicillium funiculosum</i> Thom	blue mold
<i>Penicillium hirsutum</i> Dierckx	Penicillium decay
<i>Penicillium oxalicum</i> Currie & Thom	blue mold
<i>Peronospora destructor</i> (Berk.) Casp. in Berk.	downy mildew
<i>Phoma terrestris</i> H. N. Hansen	pink root
<i>Phyllosticta allii</i> Tehon & E. Y. Daniels	Phyllosticta leaf blight
<i>Pleospora allii</i> (Rabenh.) Ces. & De Not.	Stemphylium leaf blight
<i>Puccinia allii</i> F. Rudolphi	rust
<i>Puccinia blasdalei</i> Dietel & Holw.	rust
<i>Puccinia mixta</i> Fuckel	rust
<i>Puccinia porri</i> G. Winter	rust
* <i>Pyrenochaeta terrestris</i> (H. N. Hansen) Gorenz et al.	pink root
<i>Pythium coloratum</i> Vaartaja	<i>Pythium</i> diseases
<i>Pythium graminicola</i> Subraman.	<i>Pythium</i> diseases
<i>Pythium irregulare</i> Buisman	<i>Pythium</i> diseases
<i>Pythium mamillatum</i> Meurs	<i>Pythium</i> diseases
<i>Pythium paroecandrum</i> Drechsler	<i>Pythium</i> diseases
<i>Pythium rostratum</i> E. J. Butler	<i>Pythium</i> diseases
<i>Pythium spinosum</i> Sawada	<i>Pythium</i> diseases
<i>Pythium sylvaticum</i> W. A. Campb. & Hendrix	<i>Pythium</i> diseases
<i>Pythium torulosum</i> Coker & F. Patt.	<i>Pythium</i> diseases
<i>Pythium ultimum</i> Trow	<i>Pythium</i> diseases
<i>Pythium vexans</i> de Bary	<i>Pythium</i> diseases
* <i>Rhizoctonia muneratii</i> E. Castell.	<i>Rhizoctonia</i> diseases
<i>Rhizoctonia solani</i> J. G. Kühn	<i>Rhizoctonia</i> diseases

*Rhizopus microsporus* Tiegh.  
 \**Rhizopus nigricans* Ehrenb.  
*Rhizopus stolonifer* (Ehrenb.:Fr.) Vuill.  
*Sclerotinia sclerotiorum* (Lib.) de Bary  
 \**Sclerotium bataticola* Taubenh.  
*Sclerotium cepivorum* Berk.  
*Sclerotium rolfsii* Sacc.  
*Stemphylium botryosum* Wallr.  
*Stemphylium vesicarium* (Wallr.) E. G. Simmons  
*Thanatephorus cucumeris* (A. B. Frank) Donk  
*Urocystis cepulae* Frost  
*Urocystis colchici* (Schltld.) Rabenh.  
 \**Urocystis magica* Pass. in Thüm.  
*Uromyces ambiguus* (DC.) Lév.  
*Uromyces durus* Dietel  
 \**Vermicularia circinans* Berk.

mushy rot  
 mushy rot  
 mushy rot  
 Sclerotinia rot  
 charcoal rot  
 white rot  
 southern blight  
 Stemphylium leaf spot  
 Stemphylium leaf blight  
*Rhizoctonia* diseases  
 smut  
 smut  
 smut  
 rust  
 rust  
 smudge

## Nematodes

### Scientific Name

*Belonolaimus longicaudatus* Rau  
*Ditylenchus dipsaci* (Kühn) Filipjev  
*Longidorus africanus* Merny  
*Meloidogyne chitwoodi* Golden et al.  
*Meloidogyne graminicola* Golden & Birchfield  
*Meloidogyne hapla* Chitwood  
*Meloidogyne incognita* (Kofoid & White) Chitwood  
*Meloidogyne javanica* (Treub) Chitwood  
*Paratrichodorus allius* (Jensen) Siddiqi  
*Paratrichodorus minor* (Colbran) Siddiqi  
*Pratylenchus penetrans* (Cobb) Filipjev & Schuurmans-Stekhoven  
*Trichodorus allius* Jensen  
*Trichodorus christiei* Allen

### Common Name

sting nematode  
 stem and bulb (bloat) nematode  
 needle nematode  
 root-knot nematode  
 rice root-knot nematode  
 root-knot nematode  
 root-knot nematode  
 root-knot nematode  
 stubby-root nematode  
 stubby-root nematode  
 lesion nematode  
 stubby-root nematode  
 stubby-root nematode

## Viruses and Phytoplasmas

### Scientific Name

*Artichoke yellow ringspot virus* (AYRSV)  
 Aster yellows phytoplasma  
*Garlic common latent virus* (GCLV)  
 \**Garlic latent virus* (GLV)  
*Garlic mite-borne mosaic virus* (GMbMV)  
*Garlic virus A* (GVA)  
*Garlic virus B* (GVB)  
*Garlic virus C* (GVC)  
*Garlic virus D* (GVD)  
*Garlic virus X* (GVX)  
*Iris yellow spot virus* (IYSV)  
*Leek yellow stripe virus* (LYSV)  
*Onion mite-borne latent virus* (OMbLV)  
 Onion yellows phytoplasma  
*Onion yellow dwarf virus* (OYDV)  
*Shallot latent virus* (SLV)  
*Shallot mite-borne latent virus* (ShMbLV)  
*Shallot virus X* (ShVX)  
*Tomato black ring virus* (TBRV)  
*Tomato spotted wilt virus* (TSWV)

### Common Name

artichoke yellow ringspot  
 aster yellows  
 garlic common latent  
 garlic latent  
 garlic mite-borne mosaic  
 garlic virus  
 garlic virus  
 garlic virus  
 garlic virus  
 garlic virus  
 iris yellow spot  
 garlic mosaic  
 onion mite-borne latent  
 aster yellows  
 onion yellow dwarf and garlic mosaic  
 shallot latent  
 shallot mite-borne latent  
 garlic virus  
 tomato black ring  
 tomato spotted wilt

## Pests

### Scientific Name

*Aceria tulipae* Keifer  
*Agrotis ipsilon* (Hufnagel)  
*Delia antiqua* (Meigen)

### Common Name

eriophyid mite  
 black cutworm  
 onion maggot

*Delia platura* (Meigen)  
*Eumerus strigatus* (Fallén)  
*Eumerus tuberculatus* Rondani  
*Frankliniella fusca* (Hinds)  
*Frankliniella occidentalis* (Pergande)  
*Frankliniella schultzei* (Trybom)  
*Frankliniella tenuicornis* (Uzel)  
*Liriomyza huidobrensis* (Blanchard)  
*Liriomyza sativae* Blanchard  
*Liriomyza trifolii* (Burgess)  
*Macrosteles quadrilineatus* Forbes  
*Myzus ascalonicus* Doncaster  
*Myzus persicae* (Sulzer)  
*Peridroma saucia* (Hübner)  
*Rhizoglyphus* spp.  
*Spodoptera exigua* (Hübner)  
*Spodoptera ornithogalli* (Guenée)  
*Thrips tabaci* Lindeman

seedcorn maggot  
 onion bulb fly  
 lesser bulb fly  
 tobacco thrips  
 western flower thrips  
 tomato thrips  
 thrips  
 pea leafminer  
 vegetable leafminer  
 American serpentine leafminer  
 aster leafhopper  
 shallot aphid  
 green peach aphid  
 variegated cutworm  
 bulb mites  
 beet armyworm  
 yellow-striped armyworm  
 onion thrips

## Hosts of *Allium* Pathogens and Pests

### Scientific Name

*Abelmoschus esculentus* (L.) Moench  
*Abutilon theophrasti* Medik.  
*Aeschynomene virginica* (L.) Britton et al.  
*Allium altaicum* Pall.  
*Allium ampeloprasum* L. var. *holmense* (Mill.) Asch. & Graebn.  
*Allium ampeloprasum* L. var. *kurrat* Schweinf. ex K. Krause  
*Allium ampeloprasum* L. var. *porrum* (L.) J. Gay  
*Allium bakeri* Regel  
*Allium bouddhae* Debeaux  
*Allium caeruleum* Pall.  
*Allium canadense* L.  
*Allium cepa* L.  
*Allium cepa* L. var. *aggregatum* G. Don  
*Allium cepa* L. var. *ascalonicum* Backer  
*Allium cepa* L. var. *viviparum* (Metzg.) Mansf.  
*Allium chinense* G. Don  
*Allium fistulosum* L.  
*Allium giganteum* Regel  
*Allium moly* L.  
*Allium nutans* L.  
*Allium obliquum* L.  
*Allium porrum* L.  
*Allium* × *proliferum* (Moench) Schrad. ex Willd.  
*Allium pskemense* B. Fedtsch.  
*Allium ramosum* L.  
*Allium roylei* Stearn  
*Allium sativum* L.  
*Allium schoenoprasum* L.  
*Allium tricoccum* Aiton  
*Allium tuberosum* Rottler ex Spreng.  
*Allium vavilovii* Popov & Vved.  
*Allium vineale* L.  
*Alstroemeria* sp.  
*Amaranthus retroflexus* L.  
*Ambrosia artemisiifolia* L.  
*Apium graveolens* L.  
*Arachis hypogaea* L.  
*Avena sativa* L.  
*Beta vulgaris* L.  
*Brassica oleracea* L. var. *botrytis* L.  
*Brassica oleracea* L. var. *capitata* L.  
*Capsicum annuum* L.  
*Carica papaya* L.  
*Chenopodium amaranticolor* Coste & Reyn.

### Common Name

okra  
 velvetleaf  
 northern jointvetch  
 wild onion  
 elephant garlic and great-headed garlic  
 kurrat and Egyptian leek  
 leek  
 scallion  
 Japanese bunching onion  
 blue globe onion  
 wild onion  
 onion  
 potato onion  
 shallot  
 tree onion  
 rakkyo  
 bunching onion and Welsh onion  
 giant onion  
 golden garlic  
 Siberian garlic chive  
 twistedleaf garlic  
 leek  
 walking onion  
 wild onion  
 Chinese chive  
 wild onion  
 garlic  
 chive  
 wild leek  
 Chinese chive and garlic chive  
 wild onion  
 crow garlic  
 alstroemeria  
 pigweed  
 ragweed  
 celery  
 peanut  
 oat  
 beet  
 cauliflower  
 cabbage  
 pepper  
 papaya  
 lambsquarters

<i>Chenopodium quinoa</i> Willd.	quinoa
<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	watermelon
<i>Claytonia perfoliata</i> Donn ex Willd.	miner's lettuce and winter purslane
<i>Cucumis melo</i> L.	melon and cantaloupe
<i>Cucumis sativus</i> L.	cucumber
<i>Cucurbita maxima</i> Duchesne	squash
<i>Cycas</i> sp.	cycad
<i>Cynodon dactylon</i> (L.) Pers.	Bermudagrass
<i>Datura stramonium</i> L.	jimsonweed
<i>Daucus carota</i> L.	carrot
<i>Emilia sonchifolia</i> (L.) DC.	lilac tasselflower
* <i>Epipremnum</i> sp.	pothos (ornamental)
<i>Eustoma grandiflorum</i> (Raf.) Shinnery	lisianthus
<i>Eustoma russellianum</i> (Hook.) G. Don	lisianthus
<i>Fragaria</i> × <i>ananassa</i> Duchesne ex Rozier	strawberry
<i>Fumaria officinalis</i> L.	common fumitory
<i>Glycine max</i> (L.) Merr.	soybean
<i>Gnaphalium purpureum</i> L.	purple cudweed
<i>Gomphrena globosa</i> L.	globe amaranth
<i>Gossypium hirsutum</i> L.	cotton
<i>Helianthus annuus</i> L.	sunflower
<i>Hippeastrum hybridum</i> hort. cv. Orange Sovereign	amaryllis
<i>Hordeum vulgare</i> L.	barley
<i>Ipomoea batatas</i> (L.) Lam.	sweet potato
<i>Iris hollandica</i> hort.	iris
<i>Lactuca sativa</i> L. var. <i>capitata</i> L.	lettuce
<i>Lepidium virginicum</i> L.	Virginia pepperweed
<i>Lolium multiflorum</i> Lam.	ryegrass
<i>Lupinus</i> sp.	lupine
<i>Lycopersicon esculentum</i> Mill.	tomato
<i>Malus domestica</i> Borkh.	apple
<i>Medicago sativa</i> L.	alfalfa
<i>Nicotiana benthamiana</i> Domin	annual herb
<i>Nicotiana rustica</i> L.	Aztec tobacco
<i>Nicotiana tabacum</i> L.	tobacco
<i>Oenothera lacinata</i> Hill	cutleaf evening-primrose
<i>Panicum</i> sp.	millet
<i>Pelargonium</i> × <i>hortorum</i> L. H. Bailey	geranium
<i>Petroselinum crispum</i> (Mill.) Nyman ex A. W. Hill	parsley
<i>Petunia</i> × <i>hybrida</i> hort. ex Vilm.	petunia
<i>Phaseolus lunatus</i> L.	lima bean
<i>Phaseolus vulgaris</i> L.	common bean
<i>Pinus</i> sp.	pine
<i>Pisum sativum</i> L.	field pea
<i>Poa</i> sp.	grass
<i>Portulaca oleracea</i> L.	common purslane
<i>Prunus persica</i> (L.) Batsch	peach
<i>Psophocarpus tetragonolobus</i> (L.) DC.	winged bean
<i>Pyrus communis</i> L.	pear
<i>Raphanus raphanistrum</i> L.	wild radish
<i>Rosa</i> sp.	rose
<i>Scindapsus</i> sp.	pothos (ornamental)
<i>Secale cereale</i> L.	rye
<i>Solanum melongena</i> L. var. <i>esculentum</i> Nees	eggplant
<i>Solanum sarrachoides</i> Sendtn.	hairy nightshade
<i>Solanum tuberosum</i> L.	potato
<i>Sonchus asper</i> (L.) Hill	spiny sowthistle
<i>Spinacia oleracea</i> L.	spinach
<i>Taraxacum officinale</i> Weber ex F. H. Wigg.	dandelion
<i>Tragopogon</i> sp.	salsify and goatsbeard
<i>Trifolium</i> sp.	clover
<i>Vaccinium</i> sp.	blueberry
<i>Vigna aconitifolia</i> (Jacq.) Maréchal	moth bean
<i>Vigna unguiculata</i> (L.) Walp. subsp. <i>unguiculata</i> (L.) Walp.	cowpea
<i>Zea mays</i> L.	maize and corn
<i>Zingiber officinale</i> Roscoe	ginger

# Glossary

**a.i.**—active ingredient

**C**—Celsius or centigrade ( $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times \frac{5}{9}$ )

**cm**—centimeter (1 cm = 0.01 m = 0.3937 in.)

**F**—Fahrenheit ( $^{\circ}\text{F} = (^{\circ}\text{C} \times \frac{9}{5}) + 32$ )

**g**—gram (1 g = 0.03527 oz)

**gal**—gallon (1 gal liquid [U.S.] = 3.785 liters)

**h**—hour

**ha**—hectare (1 ha = 2.471 acres)

**in.**—inch (1 in. = 2.540 cm)

**kg**—kilogram (1 kg = 2.205 lb)

**lb**—pound (1 lb = 453.59 g)

**liter**—1 liter = 1.057 quarts liquid (U.S.)

**m**—meter (1 m = 39.37 in.)

**mg**—milligram (1 mg = 0.001 g)

**min**—minute

**ml**—milliliter (1 ml = 0.001 liter)

**mm**—millimeter (1 mm = 0.001 m = 0.03937 in.)

**μg**—microgram (1 μg =  $10^{-6}$  g)

**μm**—micrometer (1 μm =  $10^{-6}$  m)

**nm**—nanometer (1 nm =  $10^{-9}$  m)

**oz**—ounce (1 oz = 28.35 g); fluid ounce (1 fl oz [U.S.] = 29.57 ml)

**ppm**—parts per million

**s**—second

**abaxial**—directed away from the stem of a plant; pertaining to the lower surface of a leaf (*see* adaxial)

**abiotic**—pertaining to the absence of life, as in a disease not caused by living organisms

**abscise**—to separate from a plant, as leaves, flowers, and fruits do when they fall

**abscission**—the shedding of leaves or other plant parts as the result of physical weakness in a specialized layer of cells (the abscission layer) that develops at the base of the structure

**acervulus** (pl. acervuli)—an erumpent, cushionlike fruiting body bearing conidiophores, conidia, and sometimes setae

**acid**—having a pH of less than 7

**acid rain**—precipitation with a low pH due to the presence of nitric and sulfuric acid formed by the combination of air pollutants ( $\text{NO}_2$  and  $\text{SO}_2$ ) with water

**acropetal**—proceeding upward from the base to the apex of a shoot of a plant; in fungi, the production of spores in succession in the direction of the apex so that the apical spore is the youngest (*see* basipetal)

**acute**—pertaining to symptoms that develop suddenly (*see* chronic)

**adaxial**—directed toward the stem of a plant; pertaining to the upper surface of a leaf (*see* abaxial)

**adventitious**—arising from other than the usual place, as in roots from a stem rather than branches of a root

**aeciospore**—a dikaryotic spore of a rust fungus produced in an aecium; in heteroecious rusts, a spore stage that infects the alternate host

**aecium** (pl. aecia; adj. aecial)—the fruiting body of a rust fungus in which the first dikaryotic spores (aeciospores) are produced

**aerial**—occurring in the air

**aerobic**—living only in the presence of oxygen

**aflatoxin**—a chemical by-product from *Aspergillus flavus* and *A. parasiticus* that is harmful to humans and other animals

**agar**—a jellylike material derived from algae and used to solidify liquid culture media; a culture medium containing agar

**alate**—winged (*see* apterous)

**albino** (n. albinism)—white or light colored; having a marked deficiency in pigmentation

**alkaline**—having basic (nonacidic) properties; having a pH greater than 7

**alkaloids**—nitrogen-containing ring compounds produced by plants that cause physiological effects in animals

**allele**—any of one or more alternative forms of a gene

**allelopathy** (adj. allelopathic)—the ability of one species to inhibit or prevent the growth of another species through the production of a toxic substance or substances

**alternate host**—one of two kinds of plant on which a parasitic fungus (e.g., rust) must develop to complete its life cycle

**anaerobic**—living in the absence of oxygen

**anamorph** (adj. anamorphic; syn. imperfect state)—the asexual form in the life cycle of a fungus, when asexual spores (such as conidia) or no spores are produced (*see* holomorph *and* teleomorph)

**anastomosis** (pl. anastomoses)—the union of branches of the same or different structures (e.g., hyphae) to make a network

**annual**—a plant that completes its life cycle and dies within 1 year (*see* biennial *and* perennial)

**antagonist**—an organism or substance that limits or counteracts the action of another

**anterior**—situated toward the front or head (*see* posterior)

**anther**—the pollen-bearing portion of a flower

**antheridium** (pl. antheridia)—the male sexual organ (male gametangium) found in some fungi

**anthesis**—the period of the opening of a flower during which pollination can occur

**anthracnose**—a disease caused by acervuli-forming fungi (order Melanconiales) and characterized by sunken lesions and necrosis

**antibiotic**—a chemical compound produced by one microorganism that inhibits growth or kills other living organisms

**antibody**—a specific protein that forms in the blood of warm-blooded animals in response to the presence of an antigen

**antigen**—any foreign chemical (normally a protein) that induces antibody formation in warm-blooded animals

**antisera** (pl. antisera)—blood serum containing antibodies

**apex** (pl. apices; adj. apical)—the tip of a root or shoot, containing the apical meristem

**aphid**—a small, sucking insect of the family Aphididae (order Homoptera) that produces honeydew and injures plants when in large populations

**aplerotic**—pertaining to an oospore that does not fill the oogonium

**apothecium** (pl. apothecia)—the open, cuplike or saucerlike, ascus-bearing fungal fruiting body (ascocarp), often supported on a stalk

**appressed** (syn. adpressed)—closely flattened down or pressed against a surface

**appressorium** (pl. appressoria)—the swollen, flattened portion of a fungal filament that adheres to the surface of a higher plant, providing anchorage for invasion by a fungus

**apterous**—wingless (*see* alate)

**arbuscule** (adj. arbuscular)—a branched haustorial structure of certain endomycorrhizal fungi that forms within living cells of the root

**arthropod**—a member of the phylum Arthropoda, which consists of animals with articulated bodies and limbs and which includes insects, arachnids, and crustaceans

**ascocarp** (syn. ascoma)—the sexual fruiting body of an ascomycetous fungus that produces asci and ascospores (e.g., apothecium, ascostroma, cleistothecium, perithecium, and pseudothecium)

**ascogenous**—pertaining to ascus-producing hyphae

**ascogonium** (pl. ascogonia)—a specialized cell that gives rise to the hyphae that produce asci

**Ascomycetes** (adj. ascomycetous)—a class of fungi, of the subdivision Ascomycotina, that produces sexual spores (ascospores) within a saclike structure called an ascus

**ascospore**—a sexual spore borne in an ascus

**ascus** (pl. asci)—a saclike structure containing ascospores (typically eight) and usually borne in a fungal fruiting body

**aseptate**—having no cross walls; lacking septa; nonseptate; coenocytic

**asexual**—vegetative; without sex organs, gametes, or sexual spores; the imperfect or anamorphic stage of a fungus

**asexual reproduction**—any type of reproduction not involving the union of gametes and meiosis

**attenuate**—to narrow; to weaken or decrease in virulence or pathogenicity

**autoecious**—in reference to rust fungi, producing all spore forms on one species of host plant (*see* heteroecious)

**autotroph**—an organism that synthesizes its nutritive substances from inorganic molecules, e.g., plants capable of photosynthesis (*see* heterotroph)

**avirulent** (syn. nonpathogenic)—unable to cause disease (*see* virulent)

**awn**—a bristlelike structure at the apex of the outer bract of some cereal and grass flowers

**axenic**—the absence of living bacteria or other organisms in a culture; describing a pure culture

**axil**—the angle formed by a leaf petiole and the stem

**axillary**—pertaining to or placed within an axil

**bacilliform**—shaped like short rods with rounded ends

**backcross**—to cross (mate) an offspring with one of its parents

**bactericide**—a chemical or physical agent that kills bacteria

**bacterium** (pl. bacteria)—a prokaryotic, microscopic, single-celled organism with a cell wall that multiplies by binary fission

**basidiocarp** (syn. basidioma)—the sexual fruiting body of a basidiomycetous fungus

**Basidiomycetes** (adj. basidiomycetous)—a class of fungi, of the subdivision Basidiomycotina, characterized by the formation of external basidiospores on basidia

**basidiospore**—a haploid (1N) sexual spore produced on a basidium

**basidium** (pl. basidia; adj. basidial)—a structure on which haploid basidiospores are produced externally

**basipetal**—proceeding downward from the apex toward the base of a shoot of a plant; referring to development in the direction of the base so that the apical part is oldest (*see* acropetal)

**bicellular**—two celled

**biennial**—a plant that produces seeds and dies at the end of its second year of growth (*see* annual and perennial)

**binary fission**—a type of asexual reproduction in which two cells, usually of similar size and shape, are formed by the growth and division of one cell

**binucleate**—having two nuclei

**bioassay**—any test (assay) using a living organism

**bioicide**—a compound toxic to many different forms of life

**biological control** (syn. biocontrol)—the exploitation by humans of the natural competition, parasitism, and antagonism of organisms, either alone or in combination, for the management of pests and pathogens

**biotic**—relating to life, as in a disease caused by living organisms

**biotroph** (syn. obligate parasite)—an organism that can live and multiply only on another living organism (*see* necrotroph)

**biotype**—a subdivision of a species, subspecies, or race based on some identifiable physiological trait, such as a specific virulence pattern

**bitunicate**—having two walls

**blade**—the flat portion of a grass leaf above the sheath

**blight**—a sudden, severe, and extensive spotting, discoloration, wilting, or destruction of leaves, flowers, stems, or entire plants

**blotch**—an irregularly shaped, usually superficial spot or blot

**botryose**—shaped like a bunch of grapes

**bract**—a reduced leaf associated with a flower or inflorescence; a modified leaf from the axil of which a flower arises

**breeding line**—a plant strain used in a plant breeding program and usually containing one or more desirable agronomic or breeding characteristics

**broadcast application**—the application of fertilizer by spreading or scattering on the soil surface

**bursa**—an extension or flap of cuticle at the side of the male nematode sex organ, used for orienting during mating

**calcareous**—rich in calcium carbonate (lime)

**callus**—specialized tissues that form over a wound or cut in a plant; cork cambium may form and the cells produced will gradually seal the wound

**canker**—a plant disease characterized (in woody plants) by the death of cambium tissue and loss, malformation, or both, of bark or (in nonwoody plants) by the formation of sharply delineated, dry, necrotic, localized lesions on the stem; the lesion itself, particularly in woody plants

**canopy**—the expanded, leafy top of a plant or plants

**capsid** (syn. coat protein)—the protective layer of protein surrounding the nucleic acid core of a virus; the protein molecules that make up this layer

**carbohydrate**—any of various chemical compounds composed of carbon, hydrogen, and oxygen (e.g., sugars, starches, and cellulose)

**carpel**—the ovule-bearing structure of a flower in angiosperms

**catena** (adj. catenulate)—a chain, e.g., of spores

**causal agent**—an organism or agent that produces a given disease

**chimera** (also chimaera)—a plant or organ consisting of two or more genetically different tissues

**chlamydospore**—thick-walled or double-walled, asexual resting spore formed from hyphal cells (terminal or intercalary) or by the transformation of conidial cells that can function as an overwintering stage

**chlorophyll** (adj. chlorophyllous)—one of a group of green pigments found in chloroplasts and important in photosynthesis

**chloroplast**—a disklike structure containing chlorophyll in which photosynthesis occurs in green plants

**chlorosis** (adj. chlorotic)—the failure of chlorophyll development caused by disease or a nutritional disturbance; the fading of green plant color to light green, yellow, or white

**chromosome**—the structure that contains the genes of an organism; in eukaryotes, chromosomes are in the nucleus and can be visualized with an optical microscope as threads or rods during meiosis and mitosis; in bacteria, the chromosome is usually a single circle of DNA that cannot be visualized with an optical microscope

**chronic**—pertaining to slow-developing, persistent, or recurring symptoms (*see* acute)

**circulative**—pertaining to viruses that pass through the gut and circulate in the body of an insect vector before being transmitted to a host

**circulative transmission**—the transmission of a virus in which the virus must accumulate within or pass through the lymphatic system of an insect vector before it can be transmitted to a plant

**cirrhous** (pl. cirrhi; also cirrus)—a curled, tendril-like mass of exuded spores held together by a slimy matrix

**clamp connection**—a bridge- or buckle-like hyphal protrusion in basidiomycetous fungi that is formed at cell division and connects the newly divided cells

**clavate** (syn. claviform)—club shaped

**cleistothecium** (pl. cleistothecia)—a spherical ascocarp that is closed at maturity

**coalesce**—to grow together into one body or spot

**coenocytic**—having multiple nuclei embedded in cytoplasm without cross walls; nonseptate

**collar**—the portion of the seedling or plant near the surface of the soil; in grafted woody plants, the scion portion of the plant near the soil surface

**colonization**—the establishment and ramification of a pathogen within a host plant

**colonize**—to infect and ramify through plant tissue with the growth of a pathogen

**colony**—a mass growth of a microorganism, especially as a pure culture

**conidiogenous**—producing and bearing conidia

**conidiophore**—the simple or branched hypha on which conidia are produced

**conidium** (pl. conidia)—an asexual, nonmotile fungal spore that develops externally or is liberated from the cell that formed it

- corolla**—petals, collectively
- cortex** (adj. cortical)—the region of parenchyma tissue between the epidermis and the phloem in stems and roots; the region beneath the rind of a sclerotium
- cotyledon**—a seed leaf, one in monocots and two in dicots; the primary embryonic leaf within the seed in which nutrients for the new plant are stored
- cross-protection**—the process whereby a normally susceptible host is infected with a less virulent pathogen (usually a virus) and thereby becomes resistant to infection by a second, usually related, more virulent pathogen
- crown**—the upper dome of a tree, bearing leaves, flowers, and fruits; the junction of the root and stem of a plant, usually at the soil line; in grafted woody plants, the rootstock portion of the plant near the soil surface
- crustose**—formed in a hard, thin layer, like a crust
- culm**—a stem of grasses, cereals, and bamboos
- cultivar** (abbr. cv.; syn. variety)—a plant type within a species, resulting from deliberate genetic manipulation, that has recognizable characteristics (e.g., color, shape of flowers, fruits, seeds, and height or form)
- cultural practices**—the manner in which plants are grown, such as application of nutrients, irrigation practices, and cultivation type; may be used for disease management
- culture**—the growth and propagation of microorganisms on nutrient media; the growth and propagation of living plants
- cuticle** (adj. cuticular)—the noncellular outer layer of an insect or nematode; the water-repellent, waxy layer of epidermal cells of plant parts, such as leaves, stems, and fruit
- cv.**—see cultivar
- cylindric**—shaped like a cylinder
- cyst**—in fungi, a resting structure in a protective membrane or shell-like enclosure; in nematode females, the egg-laden carcass of a female nematode; in bacteria, a specialized type of bacterial cell enclosed in a thick wall, often dormant and resistant to environmental conditions
- cytopathology**—the study of changes induced by disease at the cellular level
- cytoplasm**—the living protoplasm in a cell, except the nucleus
- cytoplasmic inheritance** (also extrachromosomal or maternal inheritance)—inheritance of genes not located in the nucleus, i.e., those in mitochondria and chloroplasts
- damping-off**—a disease condition resulting in death of a seedling before or shortly after emergence caused by the decomposition of the root, lower stem, or both; it is common to distinguish between preemergence damping-off and postemergence damping-off
- defoliation**—the loss of leaves from a plant, whether normal or premature
- dehiscent**—opening by breaking into parts
- demicyclic**—describing a rust fungus that lacks the urediniospore (repeating) stage (e.g., many species of *Gymnosporangium*) (see macrocyclic and microcyclic)
- desiccate**—to dry out
- diagnostic** (n. diagnosis)—referring to a distinguishing characteristic important for the identification of a disease or other condition
- dichotomous**—branching, often successively, into two approximately equal arms
- dicot** (syn. dicotyledon)—a plant with two cotyledons or seed leaves (see monocot)
- dieback** (v. die back)—the progressive death of shoots, leaves, or roots, beginning at the tips
- differential host** (syn. differential cultivar)—a plant host that on the basis of disease symptoms serves to distinguish between various strains or races of a given plant pathogen
- digitate**—having lobes radiating from a common center
- dikaryon** (adj. dikaryotic)—having two sexually compatible, haploid nuclei per cell that divide simultaneously; this phase is called the dikaryophase
- dilution end point**—the stage of a serial dilution of cells or preparations at which growth or infection from a standard sample of the suspension no longer occurs
- dimorphic**—having two distinct shapes or forms
- dioecious**—having male and female reproductive organs on different organisms (see monoecious)
- diploid**—having two complete sets of chromosomes (2N chromosomes) (see haploid and polyploid)
- disease**—a condition of abnormal functioning of an organism
- disease cycle**—the succession of all events and interactions among the host, parasite, and environment that occur in a disease, from initial infection of the plant by a causal agent, through pathogenesis, to overseasoning, until another infection occurs
- disinfect**—to eliminate a pathogen from infected plant tissues
- disinfest**—to kill pathogens that have not yet initiated disease or to kill other contaminating microorganisms that occur in or on inanimate objects, such as soil or tools, or that occur on the surface of plant parts, such as seeds
- dispersal** (syn. dissemination)—the spread of infectious material (inoculum) from diseased to healthy plants
- dissemination** (syn. dispersal)—the spread of infectious material (inoculum) from diseased plants to healthy plants
- distal**—far from the point of attachment or origin; in a direction away from main body (see proximal)
- DNA** (abbr. for deoxyribonucleic acid)—the double-stranded, helical molecule that contains genetic code information; each repeating unit, or nucleotide, is composed of deoxyribose (a sugar), a phosphate group, and a purine (adenine or guanine) or a pyrimidine (thymine or cytosine) base
- delipore septum**—a cross wall found in basidiomycetes and characterized by special swellings and membranes in association with the septal pore
- dominant**—describing a phenotypic trait that is expressed in hybrid progeny of diploid organisms even when contributed by only one of the parents (see recessive)
- dormancy** (adj. dormant)—a condition of suspended growth and reduced metabolism of an organism, generally induced by internal factors or environmental conditions as a mechanism of survival
- dormant**—resting; living in a state of reduced physiological activity
- dorsal**—pertaining to the back or top (as opposed to ventral)
- dwarfing**—the underdevelopment of a plant or plant organs, which may be caused by disease, inadequate nutrition, or unfavorable environmental conditions
- echinulate**—having small spines projecting from cell walls
- ecology**—the study of the interactions that occur between individual organisms, groups of organisms, and organisms and their environment
- ectoparasite**—a parasite that feeds from the exterior of its host (see endoparasite)
- edema** (also oedema; syn. intumescence)—blisters produced on leaves and other plant parts under conditions of high moisture and restricted transpiration
- effuse**—spread out, especially a filmlike growth
- egg mass**—a group of eggs held together by a gelatinous matrix
- ELISA**—see enzyme-linked immunosorbent assay
- ellipsoid**—elliptical in all plane sections
- embryo**—an organism in the early stages of development, such as a young plant in the seed or a nematode before hatching from the egg
- emergence**—the growth of the seedling shoot through the surface of the soil
- enation**—an abnormal outgrowth from the surface of a stem or leaf
- encapsidate**—to cover virus nucleic acid with a protein coat
- encyst**—to form or become enclosed in a cyst or protective covering
- endemic**—native to a particular place; pertaining to a low and steady level of natural disease occurrence
- endocarp**—the inner layer of a fruit wall
- endoconidium** (pl. endoconidia)—a conidium produced inside a hypha or conidiophore
- endodermis**—a layer of cells within the root between the vascular tissue and the cortex
- endogenous**—arising from the inside (see exogenous)
- endoparasite**—a parasite that lives and feeds from inside its host (see ectoparasite)
- endophyte**—a plant that develops inside another organism; also used for endoparasitic fungi found in grass species
- endosperm**—the nutritive tissue that forms within the embryo sac of seed plants
- enzyme**—a protein that catalyzes a specific biochemical reaction
- enzyme-linked immunosorbent assay** (acronym ELISA)—a serological test in which the sensitivity of the reaction is increased by



- attaching an enzyme that produces a colored product to one of the reactants
- epicotyl**—the portion of the stem of a plant embryo or seedling above the node where the cotyledons are attached (*see* hypocotyl)
- epidemic**—an increase of disease incidence in a population; a general and serious outbreak of disease (*see* epiphytotic)
- epidemiology** (adj. epidemiologic)—the study of factors influencing the initiation, development, and spread of infectious disease; the study of disease in populations of plants
- epidermis** (adj. epidermal)—the surface layer of cells of leaves and other soft plant parts
- epinasty**—the abnormal, downward curling of a leaf, leaf part, or stem
- epiphyllous**—on the upper surface of a leaf
- epiphyte**—an organism growing on a plant surface but not as a parasite
- epiphytotic**—an epidemic among plants (*see* epidemic)
- eradicate**—a chemical used to eliminate a pathogen from a host or an environment
- eradication**—the control of plant disease by eliminating the pathogen after it is established or by eliminating the plants that carry the pathogen
- erumpent**—bursting or erupting through the substrate surface
- ethylene**—a plant hormone influencing various aspects of vegetative growth, fruit ripening, abscission of plant parts, and senescence of flowers
- etiolation**—the elongation of stems caused by reduced light intensities
- etiology**—the study of the causes of diseases
- eukaryote**—an organism containing a membrane-bound nucleus and other organelles, i.e., all higher plants, animals, fungi, and protists (*see* prokaryote)
- exogenous**—originating from the outside (*see* endogenous)
- extracellular**—outside a cell
- exudate**—a liquid excreted or discharged from diseased tissues, from roots and leaves, or by fungi
- f. sp.**—*see forma specialis*
- facultative**—capable of changing life-style, e.g., from saprophytic to parasitic or the reverse
- facultative parasite**—an organism that is normally saprophytic but is capable of being parasitic
- facultative saprophyte**—an organism that is normally parasitic but is capable of being saprophytic
- fallow**—cultivated land kept free from a crop or weeds during the normal growing season
- fasciation**—the malformation in shoots or floral organs manifested as enlargements and flattening as if several parts were fused
- fascicle** (adj. fasciculate)—a small group, bundle, or cluster
- fastidious**—in reference to prokaryotic organisms, having special growth and nutritional requirements
- feeder root**—a fine root that absorbs water and dissolved nutrients
- filament** (adj. filamentous)—a thin, flexible, threadlike structure
- filamentous** (syn. filiform)—threadlike
- filiform**—long and threadlike
- flaccid**—wilted; lacking turgor
- flagellum** (pl. flagella)—a hairlike, whiplike, or tinsel-like appendage of a motile cell, bacterium, or zoospore that provides locomotion
- fleck**—a minute, discolored spot in green tissue
- flexuous**—having turns or windings; capable of bending
- focus** (pl. foci)—a small area of diseased plants within a population
- foliar**—pertaining to leaves
- forma specialis** (abbr. f. sp.; pl. *formae speciales*)—a taxonomic group within a pathogenic species defined in terms of host range, i.e., members of different *formae speciales* infect different groups of plants
- fructification**—the spore-bearing organs in both macrofungi and microfungi
- fruiting body**—any of various complex, spore-bearing fungal structures
- fumigant** (v. fumigate)—a gas or volatile substance used to kill or inhibit the growth of microorganisms or other pests
- Fungi Imperfecti** (syn. Deuteromycetes)—a class of fungi without a sexual stage; also, the asexual stage of the classes Ascomycetes and Basidiomycetes
- fungicide** (adj. fungicidal)—a chemical or physical agent that kills or inhibits the growth of fungi
- fungistat** (adj. fungistatic)—a compound that inhibits fungal growth or sporulation but does not cause death
- fusiform**—spindle shaped; tapering at each end
- gall** (syn. tumor)—an abnormal swelling or localized outgrowth, often roughly spherical, produced by a plant as a result of attack by a fungus, bacterium, nematode, insect, or other organism
- gametangium** (pl. gametangia)—a cell containing gametes or nuclei that act as gametes
- gamete**—a sex cell
- gelatinous**—resembling gelatin or jelly
- gene**—a unit within an organism controlling heritable characteristics; genes are organized on chromosomes
- genetic**—relating to heredity; referring to heritable characteristics
- geniculate**—bent, like a knee
- genome**—the complete genetic information of an organism or virus
- genotype**—the genetic constitution of an individual or group; a class or group of individuals sharing a specific genetic makeup (*see* phenotype)
- genus** (pl. genera)—a taxonomic category that includes a group of closely related (structurally or phylogenetically) species; the genus or generic name is the first name in a Latin binomial
- germ tube**—the hypha resulting from an outgrowth of the spore wall and cytoplasm after germination
- germinate** (n. germination)—to begin growth (as of a seed, spore, sclerotium, or other reproductive body)
- germplasm**—the bearer of heredity material, often loosely applied to cultivars and breeding lines
- giant cell**—an enlarged, multinucleate mass of protoplasm formed in roots by repeated nuclear division without cell division, which is induced by secretions of certain sedentary plant-parasitic nematodes
- girdle**—to circle and cut through a stem or the bark and outer few rings of wood, disrupting the phloem and xylem
- globose**—nearly spherical
- graft transmission**—the transmission of a pathogen from one host plant to another through the fusion of living tissue from the diseased host with living tissue of a healthy host
- gram-negative**—in reference to bacteria, staining red or pink in the Gram staining procedure after treatment with Gram stain
- gram-positive**—in reference to bacteria, staining violet or purple in the Gram staining procedure after treatment with Gram stain
- gravid**—in reference to nematodes, containing an egg or eggs; capable of depositing eggs
- guttation**—the exudation of watery, sticky liquid from hydathodes, especially along leaf margins
- haploid**—having a single complete set of chromosomes (*see* diploid and polyploid)
- hardiness**—the ability to withstand stress
- haulm**—stems or stalks collectively
- haustorium** (pl. haustoria)—a specialized branch of a parasite that forms inside host cells to absorb nutrients
- herbaceous**—describing a primary, soft, nonwoody tissue, as in a plant or plant part; having the characteristics of an herb
- herbicide**—a chemical used for killing plants or inhibiting plant growth (e.g., a weed or grass killer)
- hermaphrodite** (adj. hermaphroditic)—an organism having both male and female reproductive organs
- heteroecious**—in reference to rust fungi, undergoing different parasitic stages on two different, usually unrelated, hosts (*see* autoecious)
- heterokaryon** (adj. heterokaryotic)—a cell with genetically different nuclei
- heterothallism** (adj. heterothallic)—a condition in which sexual reproduction can occur only in the presence of genetically different mycelia (*see* homothallism)
- heterotroph**—an organism that is a true saprophyte (*see* autotroph)
- heterozygous**—having different forms (alleles) of a gene on homologous chromosomes, resulting from the fusion of gametes (*see* homozygous)
- holomorph**—the whole fungus in all its states (*see* anamorph and teleomorph)
- homothallism** (adj. homothallic)—a condition in which sexual reproduction occurs with a single thallus; self-fertile (*see* heterothallism)

**homozygous**—having the same form (allele) of a gene on homologous chromosomes (*see* heterozygous)

**honeydew**—a sugary ooze or exudate, often from aphids, and a characteristic symptom of ergot

**horizontal resistance**—a partial resistance equally effective against all races of a pathogen (*see* vertical resistance)

**host**—a living plant attacked by or harboring a living parasite and from which the invader obtains part or all of its nourishment

**host plant**—a living plant attacked by or harboring a parasite or pathogen and from which the invader obtains part or all of its nourishment

**host range**—the range of plants on which an organism, particularly a parasite, feeds

**hull**—the outer covering of a seed

**hyaline**—transparent or nearly so; translucent; often used in the sense of colorless

**hybrid** (v. hybridize)—the offspring of two individuals of different genotypes

**hydathode**—an epidermal leaf structure specialized for the secretion or exudation of water; a leaf opening at the terminus of a vein

**hymenium**—a continuous, spore-bearing layer of a fungal fruiting body

**hyperplasia** (adj. hyperplastic)—an abnormal increase in the number of cells, often resulting in the formation of galls or tumors

**hypersensitive**—extremely or excessively sensitive; often refers to an extreme reaction to a pathogen

**hypertrophy** (adj. hypertrophic)—an abnormal increase in the size of cells in a tissue or organ, often resulting in the formation of galls or tumors

**hypha** (pl. hyphae; adj. hyphal)—the single, tubular filament of a fungal thallus or mycelium; the basic structural unit of a fungus

**hypocotyl**—the portion of the stem below the cotyledons and above the roots (*see* epicotyl)

**icosahedral** (n. icosahedron)—having 20 faces, as in a polyhedral-shaped virus particle (*see* isometric)

**immune**—cannot be infected by a given pathogen

**immunogenic**—able to induce the production of antibodies

**imperfect state** (syn. anamorph)—the asexual form in the life cycle of a fungus when asexual spores (such as conidia) or no spores are produced

**in vitro**—in glass, on artificial media, or in an artificial environment; outside the host

**in vivo**—within a living organism

**inclusion body**—a structure that develops within a plant cell as a result of infection by a virus and is often useful in identifying the virus

**indicator plant**—a plant that reacts to a pathogen or an environmental factor with specific symptoms and is used to detect or identify the pathogen or determine the effects of the environmental factor

**infect**—the process in which an organism enters, invades, or penetrates and establishes a parasitic relationship with a host plant

**infection court**—a site in or on a host plant where an infection can occur

**infection cushion**—an organized mass of hyphae that forms on the surface of a plant from which numerous infective hyphae develop

**infection focus**—the initial site of infection, generally with reference to a population of plants

**infection peg** (syn. penetration peg)—the specialized, narrow, hyphal strand on the underside of an appressorium that penetrates host cells

**infectious**—pertaining to disease, capable of spreading from plant to plant

**infective**—in reference to an organism, able to attack a host and cause infection; in reference to a vector, carrying or containing a pathogen and able to transfer it to a host plant

**infest** (n. infestation)—to attack, as a pest (used especially of insects and nematodes); to contaminate, as with microorganisms; to be present in large numbers

**inflorescence**—a flower or flower cluster

**initial inoculum** (syn. primary inoculum)—an inoculum, usually from an overwintering source, that initiates disease in the field as opposed to inoculum that spreads disease during the season

**injury**—the damage caused by transitory interaction with an agent, such as an insect, chemical, or unfavorable environmental condition

**inoculate** (n. inoculation)—to place inoculum in an infection court; to insert a pathogen into healthy tissue

**inoculum** (pl. inocula)—a pathogen or its parts capable of causing infection when transferred to a favorable location

**inoculum density**—the number of propagules of a pathogenic organism per unit area or volume

**intercalary**—inserted within, e.g., located along a hypha as opposed to being located at the end of a hypha

**intercellular**—between or among cells

**intercrop**—to grow two or more crops simultaneously on the same area of land

**internode** (adj. internodal)—the portion of a stem between two successive nodes

**intervascular**—between (leaf) veins

**intracellular**—through or within cells

**intumescence** (syn. edema or oedema)—blisters produced on leaves and other plant parts under conditions of high moisture and restricted transpiration

**isolate**—(n.) a culture or subpopulation of a microorganism separated from its parent population and maintained in some sort of controlled circumstance; (v.) to remove from soil or host material and grow in pure culture

**isometric**—describing virus particles that are icosahedral in structure and appear approximately round

**juvenile**—an immature form that appears similar to but usually smaller than the adult and is not sexually mature (e.g., insects with gradual metamorphosis and nematodes)

**knot**—a gall; a localized abnormal swelling

**lamina**—the expanded part of a leaf (*see* petiole)

**land race**—a locally developed strain of a plant

**larva** (pl. larvae)—the immature stage of certain animals, especially insects, that undergo complete metamorphosis; the wormlike or caterpillar stage of the life cycle of such insects

**latent**—present but not manifested or visible, as in a symptomless infection by a pathogen

**latent infection**—an infection unaccompanied by visible symptoms

**latent period**—the time between infection and the appearance of symptoms and/or the production of new inoculum (sometimes synonymous with incubation period); the time after a vector has acquired a pathogen and before it can be transmitted

**leaf spot**—a plant disease lesion typically restricted in development in the leaf after reaching a characteristic size

**leaflet**—one of the separate blades or divisions of a compound leaf

**legume**—a simple, dry, dehiscent fruit that develops from a simple pistil and splits at maturity along two seams; a plant of the family Fabaceae (formerly Leguminosae)

**lenticel**—a natural opening in the surface of a stem, tuber, fruit, or root for gas exchange

**lenticular**—lens shaped (convex on both faces)

**lesion**—a localized diseased area or wound

**life cycle**—the cyclical stages in the growth and development of an organism

**lignin**—a complex organic substance or group of substances that impregnate the cell walls of xylem vessels and certain other plant cells; constitutes wood

**local lesion**—a small, restricted lesion, often the characteristic reaction of differential cultivars to specific pathogens, especially in response to mechanical inoculation with a virus

**lodge**—to fall over

**lumen** (pl. lumina)—the central cavity of a cell or other structure

**macerate**—to cause the disintegration of tissues by the separation of cells; to soften by soaking

**macroconidium** (pl. macroconidia)—the larger of two kinds of conidia formed by certain fungi (*see* microconidium)

**macrocytic**—describing a rust fungus that typically exhibits all five stages of the rust life cycle (*see* demicyclic and microcytic)

**manual transmission**—the spread or introduction of inoculum to an infection court by hand manipulation

**mating types**—compatible strains, usually designated + and – or A and B, necessary for sexual reproduction in heterothallic fungi

**mechanical injury**—an injury of a plant part by abrasion, mutilation, or wounding

**mechanical transmission**—the spread or introduction of inoculum to an infection court (wounding) by human manipulation, accompanied by physical disruption of host tissues

**medium** (pl. media)—a mixture of organic and/or inorganic chemical compounds and water that provides the nutrients needed for the growth of a microorganism in vitro; for higher plants, a mixture of fertilizers and other components in which a plant is growing

**meiosis**—a process of nuclear division in which the number of chromosomes per nucleus is halved, i.e., converting the diploid state to the haploid state (*see* mitosis)

**melanin** (adj. melanoid)—a brown-black pigment

**meristem** (adj. meristematic)—a plant tissue characterized by frequent cell division, producing cells that become differentiated into specialized tissues

**meristem culture**—an aseptically cultured plant or plant part from a portion of the meristem

**mesophyll**—the central, internal, nonvascular tissue of a leaf, consisting of the palisade and spongy mesophyll

**messenger RNA** (abbr. mRNA)—a form of RNA that carries information to direct the synthesis of protein

**metabasidium**—the part of the basidium in which meiosis occurs

**metabolite**—any chemical participating in metabolism; a nutrient

**microclimate**—weather conditions on a small scale, e.g., at the surface of a plant or within a crop

**microconidium** (pl. microconidia)—the smaller of two kinds of conidia formed by certain fungi (*see* macroconidium)

**microcyclic**—describing a rust fungus that produces only teliospores and basidiospores (*see* demicyclic and macrocyclic)

**microflora**—the combination of all microorganisms in a particular environment

**microorganism** (syn. microbe)—an organism of such small size that it can only be seen as an individual organism with the aid of a microscope

**microsclerotium**—a microscopic, dense aggregate of darkly pigmented, thick-walled hyphal cells

**middle lamella**—the layer, consisting largely of pectic substances, between the walls of adjacent plant cells

**midrib**—the central, thickened vein of a leaf

**migratory**—migrating from place to place on a plant or from plant to plant when feeding (*see* sedentary)

**mildew**—a thin coating of mycelial growth and spores on the surfaces of infected plant parts

**mitochondrion** (pl. mitochondria)—a cellular organelle outside the nucleus that functions in respiration

**mitosis**—a process of nuclear division in which the number of chromosomes remains the same (*see* meiosis)

**MLO**—*see* mycoplasma-like organism

**mold**—any microfungus with conspicuous, profuse, or woolly superficial growth (mycelium and/or spore masses) on various substrates, especially an economically important saprobe; commonly grows on damp or decaying matter and on the surface of plant tissues

**molt**—to shed a cuticle or body encasement during a phase of growth

**monocot** (syn. monocotyledon)—a plant with one cotyledon, such as grasses, grain crops, and corn (*see* dicot)

**monoculture**—the growth of the same plant species in close proximity, with few or no other types of plant present

**monoecious**—having male and female reproductive organs on a single organism (*see* dioecious)

**monogenic**—pertaining to or determined by a single gene (*see* polygenic)

**morphology** (adj. morphologic)—the study of the form of organisms; the form and structure of organisms

**mosaic**—a disease symptom characterized by nonuniform coloration, with intermingled normal, light green, and yellowish patches, usually caused by a virus; often used interchangeably with mottle

**motile**—capable of self-propulsion by means of flagella, cilia, or amoeboid movement

**mottle**—a disease symptom composed of light and dark areas in an irregular pattern, usually caused by a virus; often used interchangeably with mosaic

**mucilaginous**—viscous, slimy

**mulch**—a layer of material, such as organic matter or plastic, applied to the surface of the soil for purposes such as the retention of water and the inhibition of weeds

**multinucleate**—having more than one nucleus per cell (*see* uninucleate)

**multiseptate**—having many septa or cross walls

**muriform**—having both transverse and longitudinal septa

**mutation** (n. mutant)—an abrupt heritable or genetic change in a gene or an organism as a result of an alternation in a gene or chromosome or of an increase in chromosome number

**mycelium** (pl. mycelia; adj. mycelial)—a mass of hyphae constituting the body (thallus) of a fungus

**mycoparasite**—a fungus that attacks another fungus

**mycoplasma-like organism** (acronym MLO)—an archaic term for phytoplasma; a plant-parasitic, pleomorphic mollicute (prokaryote with no cell wall) found in phloem tissue; cannot yet be grown on artificial nutrient media

**mycorrhiza** (pl. mycorrhizae; adj. mycorrhizal)—a symbiotic association between a nonpathogenic or weakly pathogenic fungus and the roots of plants

**mycotoxin**—a poisonous compound produced by a fungus

**necrosis** (adj. necrotic)—the death of plant cells or tissue, usually accompanied by black or brown darkening

**necrotroph**—an organism that typically kills and obtains its energy from dead host cells (*see* biotroph)

**nematicide**—an agent, usually a chemical, that kills nematodes

**nematode**—a nonsegmented roundworm (animal), parasitic on plants or animals or free living in soil or water

**node** (adj. nodal)—an enlarged portion of a shoot at which leaves or buds arise

**nodule** (v. nodulation)—a small knot or irregular, rounded lump; on leguminous plants, a structure on roots that contains nitrogen-fixing bacteria

**nonpersistent transmission** (syn. stylet-borne transmission)—a type of virus transmission in which the virus is acquired and transmitted by the vector after short feeding times and is retained by the vector for only a short period of time

**nonseptate**—without cross walls; coenocytic

**nymp**—the juvenile stage in the life cycle of an insect with incomplete metamorphosis but superficially resembling the adult

**obclavate**—shaped like an upside-down club

**obligate parasite** (syn. biotroph)—an organism that can grow only as a parasite in association with its host plant and cannot be grown in artificial culture media

**obovoid**—shaped like an upside-down egg

**obtuse**—rounded or blunt; greater than a right angle

**oedema** (also edema; syn. intumescence)—blisters produced on leaves and other plant parts under conditions of high moisture and restricted transpiration

**oogonium** (pl. oogonia)—the female gametangium of oomycetes, which contains one or more gametes

**Oomycetes** (adj. oomycetous)—a class of fungal-like organisms typically with nonseptate mycelium, asexual sporangia and zoospores, and sexual oospores

**oospore**—a thick-walled, sexually derived resting spore of oomycetes

**organelle**—a membrane-bound structure within a cell having a specialized function (e.g., mitochondria and chloroplasts)

**ostiole** (adj. ostiolate)—a pore; an opening in the papilla or neck of a perithecium, pseudothecium, or pycnidium through which spores are released

**ovary**—the female reproductive structure of organisms; in plants, the enlarged basal portion of a pistil, which contains the ovules and develops into the fruit

**overseason**—to survive or persist from one planting season to the next

**oversummer**—to survive over the summer period

**overwinter**—to survive or persist through the winter period

**oviposit**—to deposit or lay eggs with an ovipositor

**ovule**—an enclosed structure that, after fertilization, becomes a seed; an egg contained within an ovary

**ozone**—a highly reactive form of oxygen (O<sub>3</sub>) that may injure plants

**palisade parenchyma**—the tissue found just beneath the upper epidermis of leaves and composed of elongate, tubular cells

- arranged upright in the manner of posts in a palisade fortification
- papilla** (pl. papillae; adj. papillate)—a small, blunt projection
- paraphysis** (pl. paraphyses)—a hairlike cell within a fungal fruiting structure
- parasexual**—the recombination of genetic characters without sexual processes
- parasite** (adj. parasitic)—an organism that lives in intimate association with another organism on which it depends for its nutrition; not necessarily a pathogen
- parenchyma** (adj. parenchymatous)—the soft tissue of living plant cells with undifferentiated, thin, cellulosic walls
- parthenogenesis** (adj. parthenogenetic)—reproduction by the development of an unfertilized egg
- pasteurization**—to free a material, usually a liquid, of selected harmful microorganisms using heat
- pathogen** (adj. pathogenic)—a disease-producing organism or agent
- pathogenesis**—the production and development of disease
- pathogenicity**—the ability to cause disease
- pathology**—the study of diseases
- pathotype**—a subdivision of a pathogen species characterized by its pattern of virulence or avirulence to a series of differential host varieties
- pathovar** (abbr. pv.)—a subdivision of a plant-pathogenic bacterial species defined by host range; pathovar for bacteria is equivalent to *forma specialis* for fungi
- pedicel**—a small, slender stalk; a stalk bearing an individual flower, inflorescence, or spore
- peduncle**—the stalk or main stem of an inflorescence; part of an inflorescence or a fructification
- penetration**—the initial invasion of a host by a pathogen
- penetration peg** (syn. infection peg)—the specialized, narrow, hyphal strand on the underside of an appressorium that penetrates host cells
- perennial**—something that occurs year after year; a plant that survives for several to many years (*see* annual and biennial)
- perfect**—sexual; capable of sexual reproduction (*see* teleomorph)
- perfect flower**—a flower that possesses both stamens and pistils
- perfect state** (syn. teleomorph)—the sexual form in the life cycle of a fungus (*see* anamorph)
- pericarp**—a fruit wall
- perithecium** (pl. perithecia)—a flask-shaped or subglobose, thin-walled fungal fruiting body (ascocarp) containing asci and ascospores; spores are expelled or released through a pore (ostiole) at the apex
- peritrichous**—having hairs or flagella distributed over the whole surface
- persistent transmission** (syn. circulative transmission)—the transmission of a virus in which the virus is acquired and transmitted by the vector after relatively long feeding times and remains transmissible for a prolonged period while in association with its vector
- pest**—any organism that damages plants or plant products
- pesticide**—a chemical used to control pests
- petiole**—the stalk portion of a leaf (*see* lamina)
- pH**—the negative logarithm of the effective hydrogen-ion concentration; a measure of acidity (pH 7 is neutral; values less than pH 7, acidic; greater than pH 7, alkaline)
- phenotype**—the physical properties of an organism produced by the interaction of its genotype with the environment
- phialide**—an end cell of a conidiophore with one or more open ends through which a basipetal succession of conidia develops
- phialospore**—a conidium produced on a phialide
- phloem**—the food-conducting, food-storing tissue in the vascular system of roots, stems, and leaves
- photochemical oxidant**—any of various highly reactive compounds formed by the action of sunlight on less toxic precursors
- photosynthate**—a product of photosynthesis
- photosynthesis**—the manufacture of carbohydrates from carbon dioxide and water in the presence of chlorophyll using light energy and releasing oxygen
- phycomycete**—an archaic term for a member of a group of fungi without cross walls (septa) in their mycelium
- phylloidy**—a change of floral organs to leaflike structures
- phyllotaxy**—the arrangement of leaves on a stem in relation to one another
- physiologic race**—a group of individuals belonging to the same species and differing from other members of the species in their behavior or other characteristics but not in morphology; a physiologic form
- phytoalexin**—a substance produced in higher plants in response to a number of chemical, physical, and biological stimuli that inhibits the growth of certain microorganisms
- phytoplasma** (syn. mycoplasma-like organism [MLO])—a plant-parasitic, pleomorphic mollicute (prokaryote with no cell wall) found in phloem tissue; cannot yet be grown on artificial nutrient media
- phytotoxic**—harmful to plants; usually used to describe chemicals
- pigment**—a colored compound, such as chlorophyll, in the cells of plants or fungi
- pinnate**—featherlike; having parts arranged along two sides of an axis
- pistil**—the ovule-bearing organ of the plant consisting of the ovary and its appendages (e.g., style and stigma)
- pith**—the parenchymatous tissue occupying the center of a stem
- plant pathology** (syn. phytopathology)—the study of plant diseases
- plasmodium** (pl. plasmodia)—a naked, multinucleate mass of protoplasm moving and feeding in amoeboid fashion
- pleomorphic**—able to assume various shapes (and perhaps sizes); having more than one distinct form in the life cycle of an organism
- plumule**—the rudimentary shoot of a plant embryo
- polar**—situated at one end or pole of a cell
- pollen**—the male sex cells produced by the anthers of flowering plants or the cones of seed plants
- pollination**—the transfer of pollen from an anther to a stigma or from a staminate cone to an ovulate cone
- polygenic**—pertaining to or determined by many genes (*see* monogenic)
- polyploid**—having three or more complete sets of chromosomes (*see* diploid and haploid)
- positive-sense RNA**—RNA that can serve directly as messenger RNA
- posterior**—situated behind or at the rear (*see* anterior)
- predispose** (n. predisposition)—to make prone to infection and disease
- primary inoculum** (syn. initial inoculum)—an inoculum, usually from an overwintering source, that initiates disease in the field as opposed to inoculum that spreads disease during the season
- primary leaf**—the first true leaf that emerges on a plant following the cotyledons
- primary root**—the root that develops directly from the radicle of an embryo rather than from a crown or node
- prokaryote** (adj. prokaryotic)—an organism without internal, membrane-bound organelles; an organism lacking a distinct nucleus, such as bacteria and mollicutes (*see* eukaryote)
- promycelium** (pl. promycelia)—in rust and smut fungi, a germ tube issuing from the teliospore and bearing the basidiospores
- propagative virus**—a virus that multiplies within its arthropod vector
- propagule**—any part of an organism capable of independent growth
- protectant**—an agent, usually a chemical, applied to a plant surface in advance of a pathogen to prevent infection
- protein**—a nitrogen-containing organic compound composed of units called amino acids
- protoplasm**—the living contents of a cell
- protoplast**—a living cell exclusive of a wall
- proximal**—nearest to the point of attachment or origin (*see* distal)
- pseudothecium** (pl. pseudothecia)—a perithecium-like fruiting body containing asci and ascospores dispersed rather than in an organized hymenium; an ascostroma with a single locule or cavity and containing bitunicate asci
- pustule**—a small, blisterlike elevation of epidermis that forms as spores emerge
- pv.**—*see* pathovar
- pycnidiospore**—a spore (conidium) produced in a pycnidium
- pycnidium** (pl. pycnidia)—an asexual, globose or flask-shaped fruiting body of certain imperfect fungi producing conidia
- pycniospore** (syn. spermatium)—a haploid, sexually derived spore that forms in a pycnium of rust fungi
- pycnium** (pl. pycnia; syn. spermagonium)—a globose or flask-shaped, haploid fruiting body of rust fungi bearing receptive hyphae and pycniospores
- pyriform**—pear shaped

**quarantine**—the legislative control of the transport of plants or plant parts to prevent the spread of pests or pathogens

**quiescent**—dormant or inactive

**race**—a subgroup or biotype within a species or variety distinguished from other races by virulence, symptom expression, or host range but not by morphology

**rachis**—the elongated main axis of an inflorescence

**radicle**—the part of the plant embryo that develops into the primary root

**receptacle**—the structure of a flower that bears the reproductive organs

**receptive hypha**—the part of a rust fungus pycnium (spermogonium) that receives the nucleus of a pycniospore (spermatium)

**recessive**—describing a phenotypic trait that is expressed in diploid organisms only if both parents contribute the trait to the progeny (*see* dominant)

**reniform**—kidney shaped

**resistant** (n. resistance)—possessing properties that prevent or impede disease development (*see* susceptible)

**respiration**—a series of chemical reactions that make energy available through the oxidation of carbohydrates and fat

**resting spore**—a spore, often thick walled, that can remain alive in a dormant state for some time and is capable of later germinating and initiating infection

**reticulate**—having netlike markings

**Rhizobium**—a genus of bacteria that lives symbiotically with roots of leguminous plants; during the symbiosis, atmospheric nitrogen gas is converted into a form useable by the plant

**Rhizobium nodules**—galls on roots caused by *Rhizobium* spp.

**rhizome**—a mostly horizontal, jointed, fleshy, often elongated, usually underground stem

**rhizomorph**—macroscopic ropelike strand of compacted tissue formed by certain fungi

**rhizosphere**—a microenvironment in the soil immediately around plant roots

**ribosome**—a subcellular, protoplasmic particle made up of one or more RNA molecules and several proteins and involved in protein synthesis

**ringspot**—a disease symptom characterized by yellowish or necrotic rings enclosing green tissue, as in some plant diseases caused by viruses

**RNA** (abbr. for ribonucleic acid)—several nucleic acids composed of repeating units of ribose (a sugar), a phosphate group, and a purine (adenine or guanine) or a pyrimidine (uracil or cytosine) base; transcribed from DNA and involved in translation to proteins

**rogue**—to remove and destroy individual plants that are diseased, infested by insects, or otherwise undesirable

**root cap**—a group of cells on a root that protects the growing tip

**root hair**—a threadlike, single-celled outgrowth from a root epidermal cell

**rosette**—a disease symptom characterized by a short, bunchy growth habit caused by shortened internodes and no comparable reduction in leaf size

**rot**—the softening, discoloration, and often disintegration of plant tissue as a result of fungal or bacterial infection

**rotation**—the growth of different kinds of crops in succession in the same field

**rugose**—wrinkled; roughened

**runner** (syn. stolon)—a slender, horizontal stem that grows close to the soil surface

**runner plants**—new plants produced asexually on a runner or stolon

**russet**—a brownish, roughened area that results from cork formation

**rust**—a disease caused by a specialized group of basidiomycetes that often produces spores of a rusty color

**sanitation**—the destruction or removal of infected and infested plants or plant parts; the decontamination of tools, equipment, containers, work space, hands, etc.

**saprobe** (syn. saprophyte)—an organism that obtains nourishment from nonliving organic matter

**saprophyte** (adj. saprophytic; syn. saprobe)—an organism that obtains nourishment from nonliving organic matter

**satellite virus**—a virus that accompanies another virus and depends on it for its multiplication

**scab**—a roughened, crustlike diseased area on the surface of a plant organ

**scald**—a necrotic condition in which tissue is usually bleached and has the appearance of having been exposed to high temperatures

**sclerenchyma** (adj. sclerenchymatous)—a tissue made up of thick-walled plant cells

**sclerotium** (pl. sclerotia)—a vegetative resting body of a fungus composed of a compact mass of hyphae with or without host tissue, usually with a darkened rind

**scorch**—any symptom that suggests the action of flame or fire on the affected part, often seen at the margins of leaves

**scutellum** (adj. scutellar)—a cotyledon of a grass embryo

**secondary infection**—an infection resulting from the spread of infectious material produced after a primary infection or from secondary infections without an intervening inactive period

**secondary inoculum**—an inoculum produced by infections that took place during the same growing season

**secondary organism**—an organism that multiplies in already diseased tissue but is not the primary pathogen

**secondary root**—a branch from a primary root

**sedentary**—remaining in a fixed location (*see* migratory)

**seed**—a ripened ovule consisting of an embryo and stored food enclosed by a seed coat

**seed treatment**—an application of a biological agent, chemical substance, or physical treatment to seed to protect the seed or plant from pathogens or to stimulate germination or plant growth

**seedborne**—carried on or in a seed

**selective medium**—a culture medium containing substances that specifically inhibit or prevent the growth of some species of microorganisms

**senesce** (adj. senescent; n. senescence)—to decline, as with maturation, age, or disease stress

**sepal**—one of the modified leaves comprising a calyx

**septate**—with cross walls; having septa

**septum** (pl. septa; adj. septate)—a dividing wall; in fungi, a cross wall

**serology** (adj. serologic)—a method using the specificity of the antigen-antibody reaction for the detection and identification of antigenic substances and the organisms that carry them

**sessile**—in reference to a leaf, leaflet, flower, floret, fruit, ascocarp, basidiocarp, etc., without a stalk, petiole, pedicel, stipe, or stem; of nematodes, permanently attached; not capable of moving about

**seta** (pl. setae)—bristle or hairlike structure, usually deep yellow or brown and thick walled

**sexual spore**—a spore produced during the sexual cycle

**sheath**—the lower part of a grass (corn) leaf that clasps the culm; a membranous cover

**shot-hole**—a symptom in which small lesions fall out of leaves, giving the leaf the appearance of being hit by buckshot

**sieve element** (syn. sieve tube element)—a tube-shaped living cell in the phloem that functions in the transport of dissolved organic substances in a plant

**sign**—an indication of disease from direct observation of a pathogen or its parts or products (*see* symptom)

**sinuous**—having many curves, bends, or turns

**slime molds**—saprophytic organisms in the class Myxomycetes that form vegetative amoeboid plasmodia and spores

**smut**—a group of fungi in the class Basidiomycetes that typically releases masses of black, dusty teliospores at maturity

**soil drench**—an application of a solution or suspension of a chemical to the soil, especially pesticides, to control soilborne pathogens

**soilborne**—carried on or beneath the soil surface

**solarization**—a disease control practice in which soil is covered with polyethylene sheeting and exposed to sunlight, thereby heating the soil and controlling soilborne plant pathogens

**sooty mold**—a black, nonparasitic, superficial fungal growth on honeydew produced by aphids and other phloem-feeding insects

**sorus** (pl. sori)—a compact fruiting structure, especially spore masses in rust and smut fungi

**sp.** (abbr. for species; pl. spp.)—a genus name followed by sp. means that the particular species is undetermined; spp. after a genus name means that several species are being referred to

**spermagonium** (pl. spermagonia; syn. pycnium, for rust fungi)—the structure in which male reproductive cells are produced; in rust fungi, globose or flask-shaped, haploid fruiting body composed of receptive hyphae and spermatia (pycniospores)

**spermatium** (pl. spermatia; syn. pycniospore, for rust fungi)—a male sex cell; a nonmotile, male gamete; a haploid, male gamete

**spicule**—a copulatory organ of a male nematode

**spikelet**—a spikelike appendage composed of one or more reduced flowers and associated bracts; a unit of inflorescence in grasses; a small spike

**spiroplasma**—a spiral-shaped, plant-pathogenic mollicute (prokaryote without a cell wall)

**sporangiophore**—the sporangium-bearing body of a fungus

**sporangiospore**—a nonmotile, asexual spore that is borne in a sporangium

**sporangium** (pl. sporangia)—a saclike, fungal structure in which the entire contents are converted into an indefinite number of asexual spores

**spore**—a reproductive structure of fungi and some other organisms that contains one or more cells; a bacterial cell modified to survive an adverse environment

**sporidium** (pl. sporidia)—a basidiospore of rusts, smuts, and other basidiomycetes

**sporocarp**—a spore-bearing fruiting body

**sporodochium** (pl. sporodochia)—a superficial, cushion-shaped, asexual fruiting body consisting of a cluster of conidiophores

**sporulate**—to produce spores

**sporulating**—producing and often liberating spores

**spot**—a disease symptom characterized by a limited necrotic area, as on leaves, flowers, and stems

**stamen** (adj. staminal)—the male structure of a flower composed of a pollen-bearing anther and a filament or stalk

**staminate flower**—a male flower

**stele**—the central cylinder of vascular tissue, especially in roots

**stem pitting**—a viral disease symptom characterized by depressions on the stem

**sterigma** (pl. sterigmata)—a small, usually pointed projection that supports a spore

**sterile**—unable to reproduce sexually; to be free of living microorganisms

**sterile fungus**—a fungus that is not known to produce any kind of spores

**sterilization** (adj. sterilized)—the total destruction of living organisms by various means, including heat, chemicals, or irradiation

**stigma**—the portion of a flower that receives pollen and on which the pollen germinates

**stipe**—a stalk

**stippling**—a series of small dots or speckles in which chlorophyll is absent

**stipule**—a small, leaflike appendage at the base of a leaf petiole, usually occurring in pairs

**stolon** (syn. runner)—a slender, horizontal stem that grows close to the soil surface; in fungi, a hypha that grows horizontally along the surface

**stoma** (pl. stomata; adj. stomatal; also stomate)—a structure composed of two guard cells and the opening between them in the epidermis of a leaf or stem that functions in gas exchange

**strain**—a distinct form of an organism or virus within a species that differs from other forms of the species biologically, physically, or chemically

**striate** (n. striation)—marked with delicate lines, grooves, or ridges

**stroma** (pl. stromata)—a compact mass of mycelium (with or without host tissue) that supports fruiting bodies or in which fruiting bodies are embedded

**stunting**—a reduction in height of a vertical axis resulting from a progressive reduction in the length of successive internodes or a decrease in their number

**style**—the slender part of many pistils located between the stigma and the ovary and through which the pollen tube grows

**stylet**—a stiff, slender, hollow feeding organ of plant-parasitic nematodes or sap-sucking insects, such as aphids or leafhoppers

**stylet-borne transmission** (syn. nonpersistent transmission)—a type of virus transmission in which the virus is acquired and transmitted by the vector after short feeding times and is retained by the vector for only a short period of time

**subepidermal**—located or occurring just below the epidermis

**subgenomic RNA**—a piece of viral RNA that is shorter than the entire genome of the virus and found in cells infected by the virus and sometimes encapsidated

**substrate**—the substance on which an organism lives or from which it obtains nutrients; a chemical substance acted upon, often by an enzyme

**sunscaled**—an injury of plant tissues burned or scorched by direct sunlight

**suscept**—an abbreviated term for a susceptible plant

**susceptible** (n. susceptibility)—prone to develop disease when infected by a pathogen (*see* resistant)

**symbiosis** (adj. symbiotic; n. symbiont)—a mutually beneficial association of two different kinds of organisms

**symptom**—an indication of disease by the reaction of the host (e.g., canker, leaf spot, and wilt) (*see* sign)

**symptomatology**—the study of disease symptoms

**symptomless carrier**—a plant that, although infected with a pathogen (usually a virus), produces no obvious symptoms

**syncytium** (pl. syncytia)—a multinucleate structure in root tissue formed by the dissolution of common cell walls induced by the secretions of certain sedentary plant-parasitic nematodes (e.g., cyst nematodes)

**synergism** (adj. synergistic)—a greater-than-additive effect of interacting factors

**synnema** (pl. synnemata; syn. coremium)—a group of compact or fused, generally upright conidiophores, with branches and spores forming a headlike cluster

**systemic**—pertaining to a disease in which the pathogen (or a single infection) spreads generally throughout the plant; pertaining to chemicals that spread internally through the plant

**taproot**—the primary root that grows vertically downward and from which smaller lateral roots branch

**taxonomy** (adj. taxonomic)—the science of naming and classifying organisms

**teleomorph** (syn. perfect state)—the sexual form in the life cycle of a fungus (*see* anamorph and holomorph)

**teliospore**—a thick-walled resting spore produced by some fungi, notably rust and smut fungi, from which the basidium is produced

**telium** (pl. telia)—a fruiting body (sorus) of a rust fungus that produces teliospores

**testa** (pl. testae)—a seed coat

**thallus**—a vegetative body of a fungus

**thermal inactivation point**—the lowest temperature at which heating for a limited period (usually 10 min) is sufficient to cause a virus to lose its infectivity or an enzyme its activity

**tiller**—a lateral shoot, culm, or stalk arising from a crown bud, especially common in grasses

**tissue**—a group of cells, usually of similar structure, that perform the same or related functions

**tissue culture**—an in vitro method of propagating healthy cells from plant tissues

**titer**—a measure of the amount or concentration of a substance in a solution

**tolerance** (adj. tolerant)—the ability of a plant to endure an infectious or noninfectious disease, adverse conditions, or chemical injury without serious damage or yield loss; of pesticides, the amount of chemical residue legally permitted on an agricultural product entering commercial channels and usually measured in parts per million (ppm)

**tomentose**—covered with a dense mat of hairs

**toxicity**—the capacity of a substance to interfere with the vital processes of an organism

**toxin**—a poisonous substance of biological origin

**translocation**—the movement of water, nutrients, chemicals, or food materials within a plant

**translucent**—so clear that light may pass through

**transmit** (n. transmission)—to spread or transfer, as in spreading an infectious pathogen from plant to plant or from one plant generation to another

**transovarial passage**—the passage of a virus through the eggs or offspring of its vector and then to the next generation of host plants

**transpiration**—the loss of water by evaporation from leaf surfaces and through stomata

**trichome**—a plant epidermal hair, of which several types exist

**triturate**—to grind, as with a mortar and pestle

**truncate**—ending abruptly as though the end had been cut

**tuber**—an underground stem adapted for storage, typically produced at the end of a stolon

**tumor** (syn. gall)—an abnormal swelling or localized outgrowth, often roughly spherical, produced by a plant as a result of attack by a fungus, bacterium, nematode, insect, or other organism

**turgid**—swollen; inflated; plump or swollen as a result of internal water pressure

**tylosis** (pl. tyloses)—a balloonlike extrusion of a parenchyma cell into the lumen of a contiguous vessel that partially or completely blocks it

**ultrastructure**—the submicroscopic structure of a macromolecule, cell, or tissue

**unicellular**—one celled

**uniflagellate**—having one flagellum

**uninucleate**—having one nucleus (*see* multinucleate)

**urediniospore** (also urediospore and uredospore)—an asexual, dikaryotic, often rusty-colored spore of a rust fungus produced in a structure called a uredinium; the “repeating stage” of a heteroecious rust fungus, i.e., capable of infecting the host plant on which it is produced

**uredinium** (pl. uredinia; also uredium)—a fruiting body (sorus) of rust fungi that produces urediniospores

**vacuole**—a generally spherical organelle within a plant cell bound by a membrane and containing dissolved materials, such as metabolic precursors, storage materials, or waste products

**variegation**—a pattern of two or more colors in a plant part, as in a green and white leaf

**variety** (adj. varietal; syn. cultivar)—a plant type within a species, resulting from deliberate manipulation, that has recognizable characteristics (e.g., color, shape of flowers, fruits, seeds, and height or form)

**vascular**—pertaining to fluid-conducting (xylem and phloem) tissue in plants

**vascular bundle**—a strand of conductive tissue, usually composed of xylem and phloem; in leaves, small bundles are called veins

**vascular cylinder** (syn. stele)—a cylinder of vascular tissue in stems or roots

**vascular wilt disease**—a xylem disease that disrupts the normal uptake of water and minerals, resulting in the wilting and yellowing of foliage

**vector**—a living organism (e.g., insect, mite, bird, higher animal, nematode, parasitic plant, and human) able to carry and transmit a pathogen and disseminate disease; in genetic engineering, a vector or cloning vehicle is a self-replicating DNA molecule, such as a plasmid or virus, used to introduce a fragment of foreign DNA into a host cell

**vegetative**—referring to somatic or asexual parts of a plant, which are not involved in sexual reproduction

**vegetative propagation**—asexual reproduction; in plants, the use of cuttings, bulbs, tubers, and other vegetative plant parts to grow new plants

**vein**—a small vascular bundle in a leaf

**veinbanding**—a viral disease symptom in which regions along veins are darker green than is the tissue between veins

**veinclearing**—the disappearance of green color in or around leaf veins

**vermiform**—worm shaped

**vertical resistance**—a resistance thought to be conferred by a single or few genes that completely protects a host but only against specific races or strains (genetic variants) of a pathogen (*see* horizontal resistance)

**vesicle**—a thin sac in which zoospores are differentiated and released; the bulbous head terminating the conidiophores of *Aspergillus* spp.; a structure formed by endomycorrhizal fungi within living cells of the root

**vessel**—a water-conducting structure of xylem tissue with pit openings in end walls

**viable** (n. viability)—the state of being alive; able to germinate, as in seeds, fungus spores, sclerotia, etc.; capable of growth

**virescence**—the state or condition in which normally white or colored tissues (e.g., flower petals) become green

**virion**—a complete virus particle

**viroid**—an infectious, nonencapsidated (naked) circular, single-stranded RNA

**viroplasm**—a cellular inclusion that is a site of the synthesis of viral components and the assembly of virus particles

**virulence**—the degree or measure of pathogenicity; the relative capacity to cause disease

**virulent**—highly pathogenic; having the capacity to cause severe disease (*see* avirulent)

**viruliferous**—virus laden, usually applied to insects or nematodes as vectors

**virus**—a submicroscopic, intracellular, obligate parasite consisting of a core of infectious nucleic acid (either RNA or DNA) usually surrounded by a protein coat

**volunteer**—a self-set plant; a plant seeded by chance

**water-soaked**—describing a disease symptom of plants or lesions that appear wet, dark, and usually sunken and translucent

**whorl**—a circular arrangement of like parts

**wild type**—the phenotype characteristic of the majority of individuals of a species under natural conditions

**wilt**—the drooping of leaves and stems from lack of water (inadequate water supply or excessive transpiration); vascular disease that interrupts normal water uptake

**witches'-broom**—a disease symptom characterized by an abnormal, massed, brushlike development of many weak shoots arising at or close to the same point

**xylem**—the water- and mineral-conducting, food-storing, supporting tissue of a plant

**yellow**—a disease characterized by the chlorosis and stunting of the host plant

**zonate**—referring to a targetlike development of tree canker characterized by successive, perennial rings of callus; referring to any symptom appearing in concentric rings

**zoosporangium**—a sporangium, or spore case, that bears zoospores

**zoospore**—a fungal spore with flagella that is capable of locomotion in water

**zygospore**—a sexual resting spore that forms from the union of gametangia in the class Zygomycetes

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