

# INDEX

- Abiotic elicitors, 305, 412
- Abscisic acid, 295
- Accumulation of biocontrol agents (BCA)-induced chitin, 390
- Accumulation of fluorescent phytoalexins, 446
- Accumulation of pathogenesis-related (PR)-proteins, 299
- Acervuli, 145
- Acetic acid as fumigant, 479
- Acibenzolar as inducer of resistance, 457
- Acibenzolar-S-methyl (ASM), 306
- Acidic electrolyzed water, 519
- Activation of defense genes by salicylic acid (SA), 439, 444
- Activation of defense responses, 286
- Activation of metabolic pathways of phenolics by UV-C light, 448
- Activation of natural defense mechanism, 435
- Activation of specific resistance genes, 294
- Active defense mechanisms, 294
- Active defense, induction of, 294
- Active oxygen species
  - antimicrobial activity of, 300
  - production of, 299
- Active resistance, 285, 315
- Acylalanine group, 487
- Adaptability of BCAs to storage and field conditions, 368
- Addition of chemical supplements, 304
- Advantages of biological control, 358
- Advantages of BIO-PCR, 26
- Advantages of dot immunobinding assay (DIBA), 29
- Advantages of using BCA mixtures, 390
- Aflatoxin biosynthesis, nucleotide polymorphism in, 222
- Aflatoxin biosynthetic gene, *nor-1*, 221
- Aflatoxin contamination of seeds, 384
- Aflatoxin pathway gene (*omt A*), 222
- Aflatoxins, 125, 316
- Agar plating technique, 34
- Agar test, 11
- Alkaline phosphatase, 37
- Alkalinization of host tissues, 138
- Alternariol in raisin fruits, 233

- Alternatives to conventional fungicides, 496  
 Aluminium chloride against soft rot of potato, 500  
 Ambient air in-store drying system, 213  
 Ambient storage conditions, 371  
 Ambient temperature before storage, 231  
 Aminobutyric acid as inducer of resistance, 458  
 Ammonium chloride for tuber treatment, 498  
 Ammonium molybdate for disease management, 496  
 Ammonium molybdate, effect on BCA efficiency, 393  
 Amperometric immunoenzyme sensor, 53  
 AmpliDet RNA technique, 38  
 Amplicons, 38  
 Amplified DNA fragments, 25  
 Amplified fragment length polymorphism (AFLP), 19, 49, 198  
 Amylase inhibitor, 221, 314  
 Anaerobic amplification, 34  
 Animal products for disease control, 411  
 Annealing step in polymerase chain reaction (PCR), 18  
 Antagonistic potential, 361  
 Antagonistic yeasts, 458  
 Antagonists, 361  
 Antagonists mixtures, 398  
 Anthracnose disease, 145  
 Antibiosis, 374, 385  
 Antibiosis tests on agar plates, 386  
 Antibiosis tests, 412  
 Antibiotic-producing BCAs, 360, 385  
 Antibiotics, resistance in pathogens to, 515  
 Antibodies to enzymes, 137  
 Antifungal compounds, 143  
 Antifungal compounds in fruits, 231  
 Antifungal dienes, 132, 138, 143  
 Antifungal hydrolases, induction by UV-C light, 448  
 Antioxidants  
   effect on aflatoxin production, 223  
   fungicidal activity of, 496  
 Antisense RNA, 439  
 Antiviral system of plants, 307  
 Apples, mycotoxins in, 232  
 Appositions on cell walls, 313  
 Appressorium, 132, 134  
 Approaches for biological control, 358  
 Aspartic proteinase (AP) activity, 140, 144, 291  
 Assay host plant, 39  
 Assessment of bacterial cell viability, 522  
 Assessment of fungal population in storage, 231  
 Assessment of fungicidal activity, 484  
 Assessment of fungicide residues, 516  
 Assessment of genetic diversity of BCAs, 399  
 Assessment of losses, 5  
 Asymptomatic plant materials, 35, 37, 38, 48  
 Attachment of cells of BCAs to pathogens, 390  
 Attributes of BCAs, 366  
 Aureobasidins, 389  
 Autofluorescence of phenolic compounds, 293  
 Availability of nitrogen to BCA, 393  
 Average reflective intensity (ARI), 233  
 Avirulence (*avr*) gene, 166, 304, 307  
 Avirulence proteins, 305  
 Avirulent strains of pathogens, 375, 376  
 Axenic cultures, 140  
  
 Bacterial antagonists against human pathogens, 381  
   postharvest pathogens, 381  
 Bacterial cell surface antigens, 24  
 Bacterial cell viability, assessment of, 522  
 Bacterial effector proteins, 165  
 Bacterial flagellin, 303  
 Bacterial pectic enzymes, 163  
 Bacteriocin, 503  
 Bacteriophages, 14  
 Bacteriophages as biocontrol agents, 374, 384  
 Basic methods for study of postharvest diseases, 555–560  
 Batch drying, 213  
 BCA, enhancement of efficiency of, 391  
 BCA in combination with controlled atmosphere (CA) conditions, 372

- BCA transformation with GFP, 370, 384
- BCA-induced phytoalexins, 391
- BCAs with low sensitivity to fungicides, 363
- BCAs for strengthening natural barriers in plants, 459
- BCAs, induction of callose accumulation by, 460
- BCAs, induction of disease resistance by, 458–461
- Benzimidazole compounds, 488
- Benzoic acid in relation to disease resistance, 289
- $\beta$ -glucanase, 317
- $\beta$ -1,3-glucanase gene, 440
- $\beta$ -1,3-glucanase of BCAs, 388
- $\beta$ -glucosidase activity, 334
- $\beta$ -glucuronidase (GUS) marker gene, 315
- Biochemical determinants of susceptibility, 139
- Biochemical tests, 13
- Biocontrol activity under controlled atmosphere (CA) conditions, 371
- Biocontrol agents (BCAs), effect on defense-related enzymes, 459
- Biocontrol, definition of, 357
- Biocontrol efficacy, 364
- Biocontrol potential, 378
- Biocontrol products, 405
- Bioengineering of plants, 437
- Biofumigant, 273
- Biofungicides, 358, 403
- BIOLOG microplate system, 14
- BIOLOG plates, 397
- Biological indexing, 40
- Biological properties of viruses, 39
- BIO-PCR technique, 26, 36, 37, 38
- Biopriming of seeds, 384
- Biosafety cabinet, 239
- Biotechnology, definition of, 435
- Biotic elicitors, 435
- Biovars, 37, 38
- Bleached skin due to chemical application, 477
- Blight diseases, 155
- Blotter test, 11
- Botrytis invertase (BIT), 46, 139
- Botulism, 237
- Bovine serum albumin (BSA), 29
- Bright greenish yellow fluorescence (BGYF) for
  - assessment of severity of ear rot, 333
  - detection of aflatoxin, 333
  - use as marker, 45
- Brix ratio, 229, 231
- Broad spectrum of activity of BCAs, 363
- Brown rot disease, 168
- Bt* gene, effect on DON concentration, 224
- Butylated hydroxyanisole (BHA), 231
- Caffeic acid as an antifungal compound, 289
- Calcium, induction of resistance by, 452
- Calcium/calmodulin signaling system, 134
- Calmodulin gene, 21
- CAMP-dependent signaling pathway, 134, 135
- Canker, 169
- Capsid polyprotein gene, 443
- Carbohydrate degradation in seeds, 123
- Carbon sources for biomass production of BCAs, 402
- Carcinogens, 4
- Cecropin A-based peptide, 400
- Cell wall appositions, 315
- Cell wall degradation, 139
- Cell wall-degrading enzymes, 142, 152, 163
- Cellulose, 293
- Cellulose-binding domain (CBD) for transformation of BCA, 401
- Certification program, 54
- Characterization of BCAs, 363
- Characterization of elicitor-binding proteins, 303
- Chemical methods, 14
- Chemical residues, 6
- Chemicals for treatment of fresh-cut produce
  - gaseous chemicals, 517
  - water-dispersible chemicals, 517
- Chemical-free products, 6
- Chemicals applied as
  - dips, 481
  - dusts, 483
  - fumigants, 476
  - sprays, 483

- Chemicals, induction of resistance by, 452–458
- Chemotypes of *Fusarium* isolates, 226
- Chitinases, 310, 314, 317, 334
- Chitin-binding lectins, 313
- Chitosan for postharvest disease control, 411
- Chitosan, beneficial effects on fruit quality, 455
- Chitosan, effect on postharvest pathogens, 454
- Chitosan, induction of resistance by, 456
- Chlorine as disinfectant, 477
- Chlorine dioxide, antifungal activity of, 478
- Chlorogenic acid, antifungal property of, 228
- Chromosomal DNA, 18
- Citrinin in apples, 232
- Classification of postharvest chemicals, 476
- Cleaved amplified polymorphic sequence marker, 329
- Climacteric fruits, 227
- CMK1* gene, role in conidial germination, 134
- Coat protein gene, 306
- Coat protein gene, detection of, 442
- Coccidial contamination of fruits, 239
- Coculturing of BCA with pathogens, 386
- Codex Alimentarius*, 489, 491
- Colonization of fresh-cut produce by human pathogens, 381
- Colonization of fruit surfaces by BCAs, 363, 366
- Colonization of host tissues by fungal pathogens, 129, 137
- Colonization of ruptured glands by BCAs, 389
- Colonization of wound sites by BCAs, 386
- Colony forming units, 14
- Color classification for tomatoes, 216
- Color of colony, 12
- Colored imprints, 17
- Combination of bacteriophages and chemicals, 380
- Combination of chemicals against diseases, 480, 489, 492
- Combination of yeast antagonists, 371
- Combinations of BCA strains, 366
- Combinations of BCAs, 376
- Combined application of avirulent strains, 375
- Compatibility of BCAs with chemicals, 368
- Compatible interaction, 285
- Competition for nutrients and space, 386
- Competitive inhibition enzyme-linked immunosorbent assay (ELISA), 46
- Competitive polymerase chain reaction (C-PCR), 19
- Competitive PCR for assessment of effectiveness of chemicals, 504
- Competitive interactions between BCAs, 397
- Concentrations of BCAs required, 363
- Confidence level of pathogen detection, 256
- Consortium of plant pathologists, 256
- Constitutive expression of resistance, 166
- Constitutive resistance, 285, 306, 309, 434
- Contaminated commodities, 9
- Contamination level, 256
- Contamination of food products with mycotoxin, 381
- Contamination of seeds with aflatoxin, 384
- Continuous flow drying, 213
- Control of TBZ-resistant strains of pathogens, 371
- Controlled atmosphere (CA)  
effect on BCAs, 368, 372  
for decay control, 228, 229, 232, 273  
production of off-flavors by, 274
- Controlled atmosphere storage, 273
- Conventional detection methods, 11
- Corona discharge, 274
- Coronatine (COR), 166
- Cost of chemicals as deciding factor for use, 487
- CP-antisense orientation, 442
- CP-sense orientation, 442
- Crop inspection, 257
- Cultivation practices, effect on disease incidence  
crop residues, 197  
crop sanitation, 195

- crop sequence, 197
- irrigation systems, 202
- mulches, 203
- nutrient management, 198
- organic farming, 204
- plant density, 202
- production systems, 202
- rootstocks, 201
- Culture filtrate for calli treatment, 436
- Curing vegetables, 218
- Cuticle thickness of berries, 293
- Cuticular fracturing, 136
- Cuticular waxes
  - accumulation of, 316
  - effect on spore germination, 133
  - water repellency of, 316
- Cutin as a natural barrier, 133
- Cutinase gene, 133
  
- Decontamination of mycotoxins, 381, 539
- Deep freezer blotter method, 25
- Defense response genes, 315, 437
- Defense responses, 299
- Defense-related compounds, 44, 144
- Defense-related enzymes, 138
- Defense-related enzymes, induction by
  - biocontrol agents, 459
  - chemicals, 454, 457, 458
  - UV-C light, 448, 449
- Defense-related signal molecules, 297
- Defense signaling compounds, 305
- Defensin gene, 290, 312
- Degradation of toxins, 375
- Demethylation inhibitor (DMI), 47
- Deoxynivalenol (DON), 20, 119, 128, 317, 332
- 2-deoxy-D-glucose (2 DOG), effect on BCA, 393
- Depletion of sugar as indicator of competition, 388
- Deposition of chitin and cellulose-enriched materials, 390
- Detection limits of aflatoxin by ELISA, 221
- Detection of CP gene in transgenic plants, 442
- Detection of immobilized amplified product in a one-phase system (DIAPOPS), 41
  
- Detection of pathogens, 4, 9
- Detection techniques, 9
- Determinants of virulence, 140
- Detoxification of phytoalexins, 377
- Development of resistance in pathogens to chemicals, 7, 378, 475
- Dicarboximide compounds, 491
- Dienes as antifungal compounds, 288
- Diffusible metabolites of BCAs, 386
- Diffusible signal molecules, 294
- Digoxigenin (DIG)-labeled PCR, 37, 41
- Dilution end point, 15
- Dilution plating, 14
- Dipping in BCA suspensions
  - cabbage heads, 378
  - tubers, 375
- Direct competitive ELISA for fumonisin detection, 223
- Direct examination of seeds, 11
- Direct interaction between BCA and pathogen, 390, 392
- Direct penetration by fungal pathogens, 132, 137
- Direct plating, 11
- Disease carry-over, 9
- Disease development, 117
- Disease incidence, influence of cultivation practices on, 193
- Disease incidence, influence of harvesting methods on, 193
- Disease management strategies, 5
- Disease management systems, 4
- Disease resistance, elicitors of, 8
- Disease resistant cultivars, development of, 319
- Disease risk assessment, 33
- DNA Detection Test Strips™, 22
- DNA-based markers, 324
- Doses of UV-C for inducing resistance, 449
- Dot blot, 29
- Dot ELISA, 29, 40
- Dot blot hybridization, 17
- Dot immunobinding assay (DIBA), 29, 40
- Double antibody sandwich (DAS)-ELISA, 39
- Double diffusion test, 28

- Drenching soil with BCA suspensions, 368
- Dry matter as index of disease resistance, 328
- Dry matter loss, 210
- Dual culture, 378
- Dual functions of avirulent strains, 375
- Durability of resistance, 434
- Durable resistance, 320
- Durables, 3, 4, 212
- Dusts of fungicide formulations, 483
- Ecological requirements of bacterial pathogens  
 environmental conditions, 99  
 host factors, 100  
 pathogen factors, 101
- Ecological requirements of fungal pathogens  
 environmental conditions, 87, 93  
 host factors, 89, 96  
 pathogen factors, 91, 97
- Ecological requirements of viral pathogens, 102
- Ecology of microbial pathogens, 79
- ED<sub>50</sub> for inhibition of pathogens, 451
- Effectiveness of fungicides, assessment by competitive PCR, 504
- Effector genes, 165
- Effector proteins, 305
- Effector-rich pathogenicity island, 165
- Efficiency of bacterial antagonists, 375
- Efficiency of colonization of fruit wounds, 370
- Electrolyte leakage, 166
- Electrolyzed oxidizing water, 481
- Electron microscopy, 30
- Electrophoresis, 18
- Elicitation of defense response by INF1, 301
- Elicitor-binding proteins, 303
- Elicitors of disease resistance, 6, 144, 298, 321
- ELISA for aflatoxin detection, 211
- ELISA for assessing chitinase levels, 438
- ELISA formats, 32, 35, 39, 52
- Endochitinase of BCA, 438
- Endochitinase, 222
- Endonuclease recognition sites, 18
- Endopectin lyase, 286
- Endophytic fungi as BCAs, 372
- Endopolygalacturonase, 138
- Enhancement of BCA efficiency, 391
- Enhancement of disease resistance, 375
- Enterobacterial repetitive intergenic consensus (ERIC)-PCR, 167
- Entry through natural openings, 137
- Environmental pollution, 6
- Enzyme patterns, 14
- Enzyme-linked fluorescent assay (ELFA), 29
- Enzyme-linked immunosorbent assay (ELISA), 16, 23, 27, 28
- Enzyme-linked oligosorbent assay (ELOSA), 370
- Enzymes, cocktails of, 137
- Epiphytic microorganisms, 362
- Epitopes, 24, 53
- Ergosterol, 225, 297
- Essential oils (EOs) for disease control, 407, 410
- Esterase gene, 134
- Esterase isozyme pattern analysis, 436
- Ethanol for treatment of fruits, 482
- Ethylene insensitivity, 436
- Ethylene perception, 436
- Ethylene production, role in disease development, 141
- Ethylene, in relation to symptom development, 301
- Ethylene-inducing elicitors, 164
- Evaluation of antifungal activity of BCAs, 415
- Evaluation of biocontrol efficiency under field conditions, 366
- Evaluation of biocontrol potential, 363
- Evaluation of disease resistance, 324
- Evaporative cooling, 214
- Exclusion, 5
- Exoantigens (ExAgs), 225
- Exoantigens in relation to DON, 225
- Exochitinase, 222
- Exogenous sources of inoculum, 193
- Expansin gene (*Le ExpI*), 439
- Expansins, 439
- Exposure of calli to culture filtrate, 436
- Expression of defense genes, 437
- Expression of *infl* gene, 301

- Extracellular polysaccharides (EPS) of  
  BCA, 390
- Extracellular polysaccharides (EPS),  
  163, 303
- Endophytic fungi as BCAs, 372
- Factors influencing storage fungi, 80
- Fatty acid profiles, 14
- Field fungi, 79
- Field resistance, 320
- Field screening, 326
- Fingerprints, 18
- Flame ionization detector (FID), 33
- Fluorescent in situ hybridization (FISH),  
  36
- Fluorescent signal, 36
- Fluorescent spots, 13
- Food additives, antifungal activity of, 498
- Food poisoning, 237
- Food products, protection of, 381
- Food safety, 358
- Foodborne human pathogens, 7, 237, 517
- Forced-air cooling, 213
- Formulations of BCAs, 401
- Formulations of chemicals, 483
- Four-way interactions of pathogen and  
  hosts, 284
- Freezing detection of fungal pathogens,  
  45
- Fresh-cut produce, protection of, 517
- Fruit maturity color chart, 216
- Fruit microflora, 85
- Fruit spoilage, 85
- Fruit volatiles, 287
- FUMI* gene encoding polyketide  
  synthase, 223
- Fumigants, 476–481
- Fumigation with essential oils, 408
- Fumonisin biosynthesis gene (*FUM*), 226
- Fumonisin contamination, 224
- Fumonisin, 21, 125, 223, 318
- Fungal toxins, 48
- Fungicidal activity, assessment of, 484
- Fungicide residues, assessment of, 516
- Fungicide resistance management, 490,  
  506, 516
- Fungicide-resistant strains of pathogens,  
  371
- Fusion of protoplasts, 436
- Gamma irradiation, 264
- Gas chromatography, 33
- Gas chromatography-mass spectrometry  
  (GC-MS) technique, 54
- Gene disruption for mutant generation,  
  140
- Gene replacement experiments, 136
- Generally regarded as safe (GRAS)  
  chemicals, 546
- Generation of signals, 289
- Genetic diversity of BCAs, 361, 398,  
  399
- Genetic engineering, 6, 434
- Genetic manipulation of BCAs, 398
- Genetic transformation of plants, 436
- Genetics of disease resistance, 322
- Genomic fingerprinting technique, 55
- Germicidal effect of ozone, 478
- GFP as indicator of yeast cell viability,  
  370
- Ghost spots, 149
- Gliotoxin in potato tubers, 376
- Glucosinolates for disease control, 409
- Glycinecin, effect on bacteria, 501
- Glyoxalase, 310
- Gold labeling, 30
- G-proteins as signaling components in  
  pathogenicity, 144
- Grain driers, 213
- Grain temperature, 83
- Gray molds, 145
- Green fluorescent protein (gfp)-tagged  
  virus, 329
- Green fluorescent protein gene (*gfp*),  
  119, 152, 162
- Growing-on test, 12, 14, 15
- Hardening periderm in carrots, 236
- Harpin (HrpN), as virulence  
  determinant, 204
- Harpin, as inducer of resistance, 458
- Harvest-related operations, effect on  
  disease incidence  
  methods of harvesting, 205  
  operations prior to harvest, 205
- Hazard Analysis and Critical Control  
  Point (HACCP) approach, 539
- Health hazards, 6, 9, 475
- Heat for pathogen elimination, 258

- Heat treatments
  - effect of curing, 268
  - effect on physiologic functions, 265
  - hot air, 265
  - hot water, 265
  - hot water brushing, 269
  - hot water dips, 268
  - hot water rinse and brushing, 270
  - phased hot water treatment, 269
  - steam treatment, 265, 271
  - vapor heat, 267
- Heat treatments, induction of disease
  - resistance, 451–452
- Heated air for drying, 217
- Horizontal resistance, 320
- Host management methods, 475
- Hot drench brushing, 540
- Hot water brushing (HWB) technique, 451
- Hot water dip (HWD) method, 452
- Hot water rinsing and brushing (HWRB) treatment, 229
- hrp* (hypersensitive response and pathogenicity) gene, 164
- Hrp secretion system (type III), 165
- Hrp-secreted proteins, 165
- Human illness outbreaks, 7
- Human pathogens on vegetables, 373
- Hydrocooling, 214
- Hydrogen peroxide plus for tuber treatment, 480
- Hydrolytic enzymes, 137, 153
- Hypersensitive cell death, 294
- Hypersensitive reaction/response (HR), 164, 301, 304, 307, 329
- Hypovirulent strains, 144
  
- Iatrogenic diseases, 360
- Identification of pathogens, 4
- Identification of sources of resistance, 327
- Imidazole compounds, 490
- Immunoassay for PL detection, 286
- Immunoblotting analysis of enzymes, 446
- Immunoblotting methods, 17
- Immunocapture-reverse transcription (IC-RT)-PCR, 31, 41, 42, 43
- Immunochromatographic method, 239
- Immunodiagnosis, 34
- Immunodiagnostic techniques, 16, 17, 23, 27
- Immunofluorescence cell staining technique, 38
- Immunofluorescence test, 24, 34, 35, 36
- Immunogen, 16
- Immunogold labeling, 46, 139
- Immunolocalization technique, 315
- Immunomagnetic beads, 15, 238
- Immunomagnetic separation (IMS), 26
- Immunomagnetic separation (IMS)-PCR, 56
- Immunoprecipitation kit VIP, 238
- Immunosorbent electron microscopy (ISEM), 30, 42
- Immuno-tissue printing technique, 309
- Importance of postharvest diseases, 4
- Imprinting of fruit peels/leaves, 361
- Improvement of biocontrol potential by genetic manipulation, 398
- Incompatible interaction, 285
- Incorporation of genes for antimicrobial compounds in BCAs, 400
- Indexing plant materials, 34, 39, 43
- Indicator plants, 39
- Indirect ELISA, 29, 35, 57
- Inducing mutations in pathogens, 399
- Induction of defense responses, 294
- Induction of enzymatic activity by UV-C light, 445
- Induction of phytoalexins by UV-C light, 446
- Induction of resistance in fruits and vegetables by
  - biocontrol agents, 458
  - chemicals, 452
  - physical agents, 445
- Induction of resistance by hot water dip, 452
- Induction of resistance, 390
- inf 1* gene expression, 301
- INF 1, pathogen-secreted elicitor, 301
- Infection hyphae, 137
- Infection of seeds by bacterial pathogens
  - entry through floral/fruit tissues, 120
  - entry through natural openings/injuries, 120

- Infection of seeds by fungal pathogens  
  entry through floral parts/fruits, 118  
  entry through natural openings and injuries, 120
- Infection of seeds by viral pathogens, 121
- Infrared irradiation as a sterilizing agent, 259
- Inheritance of resistance, 326, 328, 333
- Inhibition zone, 361
- Inoculation techniques for corn ear rot, 333
- Inoculum sources, effect on infection, 193, 195
- Integrated disease management (IDM) systems for perishables, 540–550
- Integrated management methods for foodborne pathogens, 550
- Integrated management methods for mycotoxin contamination, 538
- Integrated management methods for seedborne diseases, 538
- Intergranular atmosphere in grains, 220
- Intermittent irradiation, 259
- Internal gas atmosphere of fruits, 229
- Internal transcribed spacer (ITS), 19, 32
- International Seed Testing Association (ISTA), 11, 28, 255
- Interspecific hybridization, 329
- Intracellular washing fluids (IWF), 144
- Introgression of resistance genes, 329
- Irrigation systems, effect on disease incidence, 202
- Isolation of microorganisms, 358
- Isozyme patterns, 12, 14, 140
- Jasmonic acid (JA), effect on chilling injury on produce, 456
- JA, effect on postharvest diseases, 456
- JA in relation to disease resistance, 456
- JA as signal molecule, 290, 297
- Lactic acid bacteria (LAB) in natural food habitats, 381
- LAB, effect on pathogens, 380
- Laminarin as inducer of disease resistance, 457
- Latency, 132
- Latent infection, 33, 44, 46, 127, 132, 234
- Latex agglutination test, 28
- Lectins, 313
- Lethal dose (LD<sub>90</sub>), 481
- Leucine-rich repeats (LRR), 165, 303, 321
- Licorice, 378
- Light Cycler™ technology, 21
- Lignin deposition, 434
- Lime sulfur against citrus fruit diseases, 484
- Linkage of disease resistance, 321
- Lipase gene (*lip A*) expression, 222, 310
- Lipid degradation in seeds, 124
- Lipid peroxidation, 300
- Lipid transfer proteins (LTPs), 297, 309, 312
- Lipopolysaccharides of bacteria  
  induction of defense responses, 302  
  recognition by plants, 302
- Lipoxygenase (LOX) activity, 132, 300, 301
- Liquid chromatography, 17
- Liquid icing, 214
- Listeriosis, a foodborne illness, 238
- Localized acquired resistance, 435
- Longevity in vitro, 15
- Loss of viability of BCA, 370
- Lysis of bacterial cells by bacteriophages, 374
- Lysozyme gene of humans, 438
- Lytic bacteriophages, 380
- Lytic enzymes, 374
- Malt yeast agar for BCA isolation, 361
- Mapping of genome, 321
- Marker-assisted selection (MAS), 319, 321, 333
- Market pathology, 3
- Marketable agricultural commodities, 257
- Matching virulence genes, 320, 329
- Maximum residue limit (MRL), 149
- Mechanisms of action of lactic acid bacteria, 380
- Mechanisms of biocontrol  
  antibiosis, 385  
  competition for nutrients and space, 386  
  direct interaction (parasitism), 390  
  induction of resistance in host plants, 390

- Mechanisms of development of fungicide resistance, 507
- Mechanisms of disease resistance, 284
- Metabolic fingerprint, 14
- 6-methoxymellein, 291
- 1-methylcyclopropene (1-MCP), 229, 298
- Methyl salicylate (MSA), effect on postharvest diseases, 456
- Methyl salicylate, induction of PR-proteins by, 456
- Microbial pathogens, 3, 4
- Microflora of fruits, 85
- Microflora of vegetables, 93
- Microsatellite primer, 48
- Microwave treatment, 264
- Minimally processed fruits and vegetables, 7, 380
- Minimum effective concentration of BCAs, 362, 393
- Mitochondrial DNA, 18
- Mitogen-activated protein kinase, 135
- Mixtures of bacteriophages, 381
- Mixtures of BCAs, 373, 396
- Modes of action of fungicides
- acylalanine group, 487
  - benzimidazole and thiophanate group, 488
  - dicarboximide compounds, 491
  - imidazole compounds, 491
- Modification of BCA cells with chemicals, 364
- Modification of storage atmosphere, 273
- Modification of water activity of BCAs, 403
- Moisture levels, for seed infection, 4
- Mold diseases, 145
- Molecular beacons, 38
- Molecular biology, 6
- Molecular markers, 321, 329
- Molecular methods of detection, 16, 45
- Molecular variability of pathogens, 226
- Monitoring disease incidence, 7
- Monoclonal antibodies, 16
- Monogenic resistance, 320
- Movement protein (MP) gene of viruses, 306
- Mucilaginous secretions of spores, 132
- Mulches, effect on disease incidence, 203
- Multiplex assay, 42
- Multiplex PCR, 47
- Mummified fruits, as inoculum source, 195
- Muscodor albus*, as a biofumigant, 372
- Mutant generation by gene disruption, 140
- Mutation breeding, 435
- Mutations to reduce pathogenicity, 400
- Mycoparasite, 379, 390
- Mycotoxins, 4, 10, 16, 17, 80
- Mycotoxicoses, 5, 125
- Mycotoxin accumulation in corn (maize) seeds, 383
- Mycotoxin contamination management, 462, 538–546
- Mycotoxin contamination of feeds, 382
- Mycotoxin contamination of food products, 381
- Mycotoxin contamination of seeds, 125
- Mycotoxin contamination of fruits, 222, 232
- Natural microflora, 361
- Near infrared (NIR) spectrum, 52
- Necrotrophic pathogens, 119
- Negative air ions (NAI), 275
- Nested PCR, 49
- Nested primers, 33
- Nitrogenous compounds, effect on BCA, 393, 402
- Nitrous oxide, inhibitory effect of, 480
- Nonclimacteric fruits, 227
- Nonhost specific toxin, 166
- Nonspecific resistance, 320
- Nonsystemic fungicides, 483, 484
- Nontoxigenic strains of *Aspergillus*, 384
- Nucleic acid sequence-based amplification (NASBA), 38
- Nucleic acid-based techniques, 17, 30, 32
- Nucleotide polymorphism in AF biosynthesis, 222
- Nucleotide sequencing, 18
- Nucleotide-binding leucine-rich repeat (NB-LRR) proteins, 305
- Nutrients, effect on disease incidence
- calcium, 200
  - inorganic fertilizers, 199
  - nitrogen, 199
  - organic matter, 198
  - other minerals, 200

- Nutrient utilization patterns of BCAs, 397
- Nutrient yeast dextrose agar for BCA isolation, 361
- Ochratoxin A, production of, 222, 233
- Ochratoxins, 126, 227
- Off-flavors due to chemical application, 476
- One-step PCR, 37
- Organic farming, effects on disease incidence, 204
- Organoleptic acceptance, 274
- Ouchterlony double diffusion test, 23, 27
- Outbreaks of human illness, 7
- Over expression of genes for lytic enzymes of BCAs, 400
- Oxidative burst, 300
- Ozone, germicidal effect of, 478, 519
- Ozone treatment, 274
  
- Parameters for selection of BCAs, 373
- Parasitism, 390
- Passive defense mechanisms, 292
- Passive resistance, 285
- Patatin, 292
- Pathogen-derived molecules, 303
- Pathogen-derived resistance, 441
- Pathogenesis, 5, 117, 164
- Pathogenesis-related (PR)-proteins, 143, 294, 313
- Pathogenesis-related maize seed (PRms) proteins, 315
- Pathogen-free products, 6
- Pathogen management methods, 475
- Pathogen quiescence, 28
- Pathogen recognition specificity, 305
- Pathogen-secreted elicitor INF1, 301
- Pathogen transformation, 137, 140, 152, 315
- Pathogenic causes, 4
- Pathogenicity, 34, 136, 139
- Pathogenicity-enhancing factor, 155
- Pathogenicity factors, 127, 137
- Pathogenicity island, 165, 167
- Pathogenic potential, 5, 131
- Pathosystem, 140
- Pathovars, 37, 165
- Patulin in apples, 232
- Patulin production, 222
- Pectate lyase, 293
- Pectate lyase gene (*pel*), 137, 440
- Pectin degradation, 139
- Pectolytic enzyme-inducing medium (PEIM), 137
- Pelleting seeds with BCA, 383
- Penetration through natural openings, 137
- Peracetic acid as fumigant, 479
- Perception of ethylene, 436
- Period of mold-free days, 231
- Perishable commodity, 212
- Perishables, 4
- Permatin, 314
- Phage mixtures against foodborne pathogens, 381
- Phage-display antibody, 46
- Phage-display library, 35
- Phaseolotoxin, 166
- Phenylpyrroles, 494
- Phenylalanine-ammonia lyase (PAL) activity, 296
- Phosphate-mediated cell death, 454
- Phosphates, as SAR signal, 453
- Phosphates, effect on defense-related enzymes, 453
- Phyllosphere, coverage by BCAs, 378
- Phylogenetic relationship, 18
- Physical agents, 6
- Physical methods of disease management, 255
- Physiologic causes, 4
- Physiological quality of seeds, 258
- Phytoalexin detoxification mechanism, 142
- Phytoalexin production, induction by BCAs, 391
- Phytoalexins, 290
- Phytotoxins, 166, 375
- Plant compounds for disease management, 404, 410
- Plant growth-promoting rhizobacteria (PGPR), 374
- Plant quarantines, 11
- Plaque formation, 15
- Plaque forming units (PFU), 374
- Plasmid carrying pathogenicity island, 167

- Plasmid DNA fragment, 50
- Plate-trapped antigen (PTA)-ELISA, 240
- Poisoned food technique, 484
- Polyclonal antiserum, 16
- Polyethylene packaging, 260
- Polygalacturonase (PG) expression, 138, 139
- Polygalacturonase-inhibiting proteins (PGIPs), 142, 293, 311, 437
- Polygenic resistance, 320, 327
- Polymerase chain reaction (PCR), 18, 25, 26, 32
- Polymerase chain reaction (PCR)-RFLP, 56
- Polyphenol oxidase (PPO) activity, 317
- Polyvalent bacteriophages, 374
- Postharvest cooling
  - evaporative cooling, 214
  - forced air cooling, 213
  - hydrocooling, 214
  - room cooling, 213
  - top/liquid icing, 214
- Postharvest handling
  - curing and waxing, 218
  - packaging, 218
  - sorting and grading, 218
  - washing, cleaning and trimming, 217
- Postharvest pathology, 3
- Post-transcriptional gene silencing (PTGS), 307
- Powder formulations of BCAs, 404
- Pre- and postharvest chemical application, 476
- Pre- and postharvest control of mycotoxin contamination, 539
- Precipitin lines, 27
- Precipitin rings, 27
- Preformed antifungal compounds, 144
- Preformed antimicrobial compounds, 117, 142, 265
- Preharvest sprays of BCAs, 366
- Preventive methods for disease management, 258
- Primary inoculum of infection, 196
- Primary screening of microorganism for antagonistic activity, 362
- Primary sources of infection, 255, 382
- Primary symptoms, 307
- Primed-PCR profiles, 167
- Primers- external, internal and satellite, 48
- Priority of microbial pathogens, 10
- Proanthocyanidins (PAs), 288, 296
- Process of infection by bacterial pathogens
  - colonization of host tissues, 163
  - entry into host tissues, 162
  - symptom expression, 167
- Process of infection by fungal pathogens
  - adhesion to host cell, 129
  - colonization of host tissues, 129, 137, 138
  - entry into host tissues, 132
  - spore germination, 128
  - symptom expression, 145
- Process of infection by viral pathogens, 170
- Process of pathogen recognition, 286
- Production of disease-free seeds, 256
- Products free of chemicals, 6
- Programmed cell death (PCD), 294, 295, 304
- Propagative materials, 9
- Prosystemin, 298
- Prosystemin expression, 439
- Protectant fungicides, 483
- Protein binding sites, 29
- Protein degradation in seeds, 124
- Protein inhibitor I expression, 298
- Protein kinase (p51-PK), 301
- Proteinase inhibitor, synthesis of, 434
- Proteinase inhibitors, 286
- Protein-protein interaction, 331
- Proteolytic enzymes of pathogens, 142
- Protoplast fusion, 436
- Pto-mediated resistance, 301
- Pyrrolnitrin, as antifungal compound, 377
- Qualitative losses, 4
- Quantification of fungal biomass, 240
- Quantitative assessment of infection, 257
- Quantitative competitive (QC)-PCR, 37, 370
- Quantitative ELISA, 45
- Quantitative losses, 4
- Quantitative PCR, 20

- Quantitative real-time PCR, 23, 238  
Quantitative resistance, 324  
Quantitative trait loci (QTL), 321, 324, 332  
Quarantine measures, 256  
Quiescence, 44  
Quiescent infection, 32, 44, 48, 127, 285
- Race-specific resistance, 327  
Radioactive probes, 24  
Radioimmunoassay (RIA), 29  
Random amplified polymorphic DNA (RAPD), 26, 48, 49, 55, 321  
RAPD for identification of BCA isolates, 361  
RAPD-PCR, 53, 55  
Rapid diagnosis medium, 14  
Reactive oxygen species (ROS), 127, 287, 294  
Real-time fluorescence, 36  
Real-time fluorescence RT-PCR, 42  
Real-time PCR, 21, 36  
Receptor-like protein kinases (RLKs), 303  
Receptors of elicitors, 303  
Recognition of pathogens by plants, 286  
Recombinant junctions (RJs), 42  
Recontamination of heat-treated fruits, 272  
Regeneration of plants from calli, 436  
Regulation factors, 164  
Regulation of defense mechanism in fruits and vegetables, 445  
Regulations on use of chemicals, 476  
Regulatory genes, 164  
Regulatory proteins, 164  
Rehydration medium for freeze-dried BCA cells, 402  
Repetitive sequence-based (rep)-PCR, 55  
Replicase protein gene of viruses, 306  
Residual chemicals, 378  
Residue tolerances for TBZ, 489  
Residue-free products, 476  
Residues of chemicals, 6  
Resin glycosides, as antifungal compounds, 289  
Resistance gene analogs (RGAs), 331  
Resistance mechanisms, 320  
Resistance to chemicals, 7  
Resistance to  
  bacterial diseases, 301  
  fungal diseases, 292  
  viral diseases, 306  
Resorcinol as antifungal compound, 143, 287  
Respiratory burst, 300  
Restriction enzymes, 18  
Restriction fragment length polymorphism (RFLP), 18, 25, 42  
Resveratrol in relation to disease resistance, 297  
Reverse transcription (RT)-PCR, 30, 41, 42  
RFLP markers, 324  
Rhodotorulic acid, 389  
Ribosomal repeat DNA, 22  
Ribosomal RNA gene cluster, 222  
RNA-binding proteins (RPBs), 307  
Ribosome-inhibiting proteins (RIPs), 221, 309, 310  
Ripening process, 4  
RNA interference (RNAi), as antiviral system, 307  
RNA silencing, 308  
Rot diseases, 149  
Rouging infected plants, effect on disease incidence, 194  
RT-PCR for mRNA levels, 222
- Salicylic acid (SA) as endogenous transduction signal, 297, 439  
Salmonellosis, a foodborne illness, 230  
Salt solution for seed selection, 257  
Sanitizing effects of wax, 260  
Saprophytic survival of BCAs, 379  
Scab disease, 159  
Scanning electron microscopy for ultrastructural studies, 135, 173  
SCAR markers for BCA identification, 362  
Scopoletin, 297  
Scopolin, 297  
Screening for disease resistance, methods of, 328, 336–338  
Screening of microorganisms for biocontrol potential, 362  
Screening techniques, 436

- Scurf disease, 159
- Secondary screening of BCAs, 362
- Seed deterioration caused by  
  bacterial pathogens, 126  
  fungal pathogens, 122  
  viral pathogens, 126
- Seed extracts for disease management, 409
- Seed health testing, 10, 194, 257
- Seed immunoblot assay (SIBA), 17
- Seed infection by  
  bacterial pathogens, 126  
  fungal pathogens, 117  
  viral pathogens, 126
- Seed-inhabiting bacteria, 85
- Seed-inhabiting fungi, 79
- Seedling symptom test, 12
- Seed microflora, 79, 382
- Seed moisture, 219
- Seed mycoflora, 79
- Seed quality as affected by  
  carbohydrate degradation, 123  
  contamination of seeds with  
  mycotoxin, 125  
  lipid degradation, 124  
  protein degradation, 124
- Seed-to-plant transfer of pathogens, 14
- Seed-to-spoon protection for food safety, 539
- Seed treatment with BCAs, 382, 383
- Seed treatment with chemicals, 503–506
- Seeds as primary sources of infection, 382
- Selection pressure on pathogens, 434
- Selective media, 11
- Semiselective enrichment broth (SSEB), 24
- Semiselective medium, 12, 34, 54
- Senescence process, 4
- Separation of seeds by vertical air stream, 257
- Sequence characterized amplified region (SCAR), 54, 194, 321
- Serodiagnostic methods, 39, 40
- Serological properties, 40
- Serotypes, 35
- Serovars, 24, 35
- Shattering of grape berries, 230
- Shelf-stable BCA products, 401, 403
- Short wave infrared irradiation, 264
- Siderophores, 389, 394
- Signaling pathways, 134, 136
- Signal transduction, 331
- Signal transduction pathways, 136
- Silicon, effect on defense-related enzymes, 501
- Silicon against fruit decay, 501
- Silicon, effect on postharvest diseases, 395
- Simulated quarantine treatment, 541
- Single gene resistance, 320
- Site of stimulus, 435
- Slide agglutination test, 23, 54
- Small subunit(SSU) rDNA primer, 46
- Smudge disease, 159
- Snakin (StSN2), as a defense compound, 291, 439
- Sodium metabisulfite against soft rot, 500
- Soft rot diseases, 167
- Soil, as reservoir of *Salmonella*, 239
- Soilborne sources of inoculum, 195
- Solid-phase microextraction (SPME) fiber, 33
- Somaclonal variation, 435
- Somatic hybrid, 436
- Sources of inoculum, 193
- Sources of resistance, 284, 322, 327, 328
- Standard enrichment technique, 238
- Storability of harvested produce, 435
- Storage bags, types of, 258
- Storage conditions for  
  fruits, 227  
  seeds, 219  
  vegetables, 233
- Storage fungi, characteristics of, 80
- Storage temperature, 84
- Strobilurins, 493
- Structural barriers, 294
- Structural defense responses, 314
- Subserovars, 24
- Sulfur dioxide, 476
- Surface plasmon resonance (SPR)-based indirect inhibitive immunoassay, 225
- Survivability of fungal pathogens, 195
- Survival periods and rates of BCAs, 364, 368
- Symptom expression, 117

- Symptom expression of bacterial diseases  
 brown rot, 168  
 canker, 169  
 soft rots, 167  
 spots, 189
- Symptom expression of fungal diseases  
 anthracnose, 145  
 blights, 155  
 melanose, 158  
 molds, 145  
 rots, 149  
 scab, 159  
 scurf, 159  
 smudge, 159  
 smut, 159  
 spots, 161  
 wart, 161
- Symptom expression of viral diseases, 171
- Symptomatic plant parts, 48
- Synthetic hexapeptides against molds, 501
- Syringomycin, 285
- Syringomycin biosynthesis gene (*syrB*), 386
- Systemic acquired resistance (SAR), 435
- Systemic fungicides, 476, 484, 487–496
- Systems of disease management, 4, 9
- Talc-based formulations of BCAs, 368
- Taq Man<sup>®</sup> technology, 21
- Taxon, 18
- T-DNA region of *Agrobacterium tumefaciens*, 437
- Templates, 18
- Thaumatin-like proteins (TLPs), 143, 290, 309, 313
- Thaxtomin A, conversion of, 375
- Thermal inactivation point, 15
- Thermotherapy, 259
- Thermus aquaticus*, 18
- Thiobendazole (TBZ)-resistant strains of pathogens, 371
- Thionin-like gene, 290
- Thionins, 310, 441
- Tillage, effect on disease incidence, 201
- Tissue alkalization, 138
- Tissue blot immunoassay (TBIA), 40
- Tissue culture plates with cylinder inserts, 387
- Tolerance level, 28, 194
- Tolerance limit of seed infection, 255
- Tolerance of BCAs to adverse conditions, 363, 368
- Tolerance of zero infected seeds, 256
- Tomatine as antifungal compound, 287
- Top icing, 214
- Toxic metabolites, 10
- Toxin producing fungi, 48, 137, 140
- Transformation of BCAs with pectate lyase gene, 440
- Transcriptional activation of enzymes, 163
- Transcriptional enhancer, 47
- Transfer of resistance genes, 284
- Transformation for resistance to mycotoxins, 462
- Transformation of BCAs, 400
- Transformation of BCAs with endochitinase gene, 438
- Transformation of plants with chitinase genes, 438
- thionin gene, 441
- viral genes, 441
- Transgenic cultivars, 441
- Transgenic plants, 330, 436
- Transmission electron microscope (TEM) studies, 174
- Triazoles as preharvest fungicides, 493
- Trichodiene synthase gene (*Tri 5*), 225, 318
- Trichothecene biosynthesis (*Tri* genes), 226
- Trichothecenes, 20, 125
- Trypsin inhibitor, 314
- Tube agglutination test, 23
- Tube capture (TC)-RT-PCR, 56
- Tuber treatment with BCAs, 376
- Tumor-inducing (Ti) plasmid, 437
- Type III secretion system (TTSS), 164
- Types of storage bags, 258
- Ultraviolet (UV)-C light, effect on disease incidence, 6, 259
- UV-C light, delayed ethylene production by, 234
- UV-C light, disinfection effect of, 263

- UV-C light, induction of disease  
  resistance by, 263, 445–451
- UV-C treatment, negative effects of, 449
- Vacuum cooling, 214
- Vat* gene, effect on vector transmission,  
  309
- Vegetables as reservoir of *Salmonella*,  
  380
- Vegetative compatibility groups (VCGs),  
  19, 221
- Vertical resistance, 327, 329
- Vinclozolin, as preharvest fungicides, 492
- $\epsilon$ -viniferin, 297
- Virobacterial agglutination (VBA) test,  
  23
- Virulence, 5, 138
- Virulence determinants, 140, 163, 164,  
  304
- Virulence effector proteins, 166
- Virulence factors, 140, 163
- Virus resistance genes, 304
- Visible moldiness, 220
- Volatile compounds for treatment of  
  fruits, 481
- Volatile organic compounds, 54
- Volatiles from grapes for disease  
  management, 408
- Volatiles from *Muscodor albus*, 372
- Volatiles from potato, 33
- Water activity, 82, 220
- Water activity tolerance of BCAs,  
  364
- Water as reservoir of *Salmonella*,  
  239
- Waxing  
  advantages of, 260  
  effects of, 260
- Waxy cuticle, water repellency of,  
  292
- Western blots, 46
- Wetness period, in relation to decay, 230,  
  235
- Wettable powders, 483
- Working sheets for seedborne  
  pathogens, 11
- Wound healing process, 236
- Wound response genes, 162
- Wound volatile compounds, 136
- WRKY proteins, role in gene regulation,  
  303
- Yeast cells for decontamination of  
  mycotoxins, 381
- Yield of transgenic plants,  
  444
- Zearalenone, 125
- Zero tolerance, 255
- Zymotypes, 14