

Index

a

- abamectin 1495
 - biological activity 1593–1594
 - mites and insects 1488
 - mode of action 1592–1593
 - nematicidal seed treatment 1593
- abamectin, crop protection 1496
- abiotic stress 571, 574, 577, 579, 828, 959, 960, 1328, 1330
- abscisic acid (ABA) 305, 351, 573
- acaricidal 614, 662–664, 706, 718, 734, 736, 992, 1092–1095, 1156, 1163, 1171, 1173–1176, 1178, 1181, 1184, 1186, 1204, 1490, 1529
 - carboxamides 1176
- acaricide 627
 - cross-resistance 1177–1178
 - in vitro* selectivity 1179–1180
 - IRAC classification 1180–1181
 - lead compound 1174–1175
 - mechanisms 1156
 - mode of action 1178–1179
 - structure–activity relationship (SAR) 1176–1177
 - synthesis 1177
 - toxicity 1178
- acaricide pyflubumide 1177
- accessory proteins 392, 1543
- acequinocyl 1176, 1181–1182, 1189
- acetamides 9, 11, 359, 398
- acetamiprid 1273–1276
 - chemical classification of 1273–1274
 - insecticidal activity 1275
 - physico-chemical properties 1273–1274
- acetoacetate 328, 686, 1164, 1171
- acetochlor 274, 375, 431, 468, 469, 473, 564
- acetogenin 614
- acetoxyacid synthase (AHAS) 3, 8, 18, 33–51, 55, 72, 97, 109, 122, 152
 - binding site of 40–45
 - crops engineered resistance 50–51
 - flavin adenine dinucleotide (FAD) 36
 - herbicides target 39–40
 - heterotetramer subunits 36
 - HETHDP 34
 - inhibitors 18–19
 - molecular basis for 45–48
 - subunit structure 37–39
 - ThDP 34
 - weed resistance 48–50
- acetolactate 33
- acetolactate synthase (ALS)
 - Alopecurus myosuroides* 13
 - herbicides 331
 - inhibitors 346, 532
 - pyrimidinylcarboxylate inhibitors 128
- acetylcholine (ACh) 1229, 1348
- acetylcholine binding proteins (AChBPs) 1233, 1240, 1288
- acetylcholine esterase (AChE) 1242, 1244–1245, 1591

- acetyl-CoA carboxylase
 (ACCCase) 1207–1211
 carboxylate transferase (CT)
 function 501
 chemical classes of 16
 commercialised ACCCase
 aryl-1,3-diones (DENs) 510
 aryloxyphenoxypropionates
 (AOPPs/fops) 507–508
 cyclohexanediones (CHDs/
 dims) 508–510
 dicot tolerance 501
 inhibitors 253
 IPM
 Envidor[®] 1211–1212
 Oberon[®] 1211–1212, 1218
 multisubunit and multifunctional
 enzyme 502
 patent applications
 2-aryl-cyclohexane-1,3-dione
 derivatives 517–519
 2-aryl-cyclopentane-1,3-
 diones 511–517
 aryl pyran-and piperidine-
 diones 520–524
 2-aryl-pyrazolo-1,3-
 diones 524–525
 2-aryl-pyridazine-1,3-diones 525
 2-aryl-tetramic and 2-aryl-tetronic
 acids 519–520
 in plants 503
 resistance 507
 spirodiclofen
 cyclic ketoenols 1202–1205
 synthesis of 1206–1207
 spiromesifen
 cyclic ketoenols 1202–1205
 discovery of 1212–1214
 mode of action 1216–1218
 synthesis of 1206–1207
 transcarboxylation reaction 502
 acetyl-coenzyme A (acetyl-CoA) 1631
 ACh-binding site 1233
 acibenzolar-*S*-methyl 959, 966–967
 synthesis 965–966
 systemic acquired resistance
 induction 966–967
 Acuron[®] 204, 274, 278, 429, 430
 acylation 138, 278, 396, 513, 850, 861,
 950, 951, 1017, 1019, 1096, 1207,
 1214, 1626
 acyl carrier protein (ACP) 353, 1416
 2-Acylimino-3-phenylthiazolines 231
Aedes aegypti 1024, 1025, 1073, 1077,
 1361, 1453
 aflastatin A 882
 agonists vs. antagonists 1254–1255
Agriotes spp. 1303, 1464
Agrobacterium 456, 461, 1104, 1106
 agrochemical fungicides 728
 AKD-1022 1316–1317
Alabama argillacea 1465
 Alion[™] 407
 alkaloid ryanodine 993, 1541, 1568
 alkylazines
 biology of 406–407
 chemistry of 403–406
 2-alkylthio-3-aminobenzoic acids 965
 alkynyl amide 791
 4-alkynyl-2-anilinopyrimidines 751
 allosteric modulators 993, 1224,
 1400–1418, 1455, 1478–1497
 alloxym-sodium 934
 allylamines 604, 802, 838, 839
Alopecurus myosuroides 13, 17, 64, 69,
 119–121, 151, 364, 446, 507
Amaranthus
A. palmeri 13, 203, 376, 464
A. tuberculatus 19, 203, 299, 464
Amblyomma americanum 1282
 ametoctradin 601, 634, 636, 665, 667,
 674, 793
 amicarbazone
 active ingredient, discovery
 of 560–562
 biological behavior 564
 metabolites 564
 physico-chemical properties 559
 synthesis 562–563
 amidoflumet
 biology and biochemistry 1529
 discovery and
 development 1527–1529
 registration 1529

- structure of 1528
- synthesis of 1528
- amino acid amides
 - aminosulfones 854–856
 - benthiavalcarb 852–853
 - iprovalicarb 850–852
 - N*-sulfonyl amino acid amides 856
 - valifenalate 853–854
- aminoalkylpyrimidines
 - diflumentorim 729
 - structure–activity relationship (SAR) 731
 - structure of class 729
- 5-amino-3-cyano-pyrazole 1461
- aminocyclopyrachlor
 - chemical and physical properties 331–336
 - herbicidal activity 331–336
 - mode of action 336
 - resistance management 338
 - site of action 336
 - soil and environmental behavior 336–338
- 4-amino-3,5-dichloropicolinate 320
- 4-amino-3,5-dichloropicolinic acid 319
- 4-amino-3-isopropyl-1,2,4-triazol-5-one 563
- 4-amino-6-methyl-4,5-dihydro-1,2,4-triazin-3(2H)-one 1506
- 3-amino-3-methyl-1-pentyne 791
- aminomethyl phosphonic acid (AMPA) 455
- 4-aminomethylpyrimidines 742
- aminopyralid 321
 - chemistry 322
 - discovery of 321–322
 - herbicidal utility and application 323–325
 - mode of action 322–323
- amino-pyrazolinones 835–836
- 4-aminopyridine 734–738
- 4-aminopyridine, *N*-(4-pyridyl)biphenyl acetic acid amide 734
- aminopyrimidines 738–739
- aminoquinazolines 738–739
- aminoquinazolinones
 - derivatives 1520
 - structure-activity 1519
- 4-aminoquinolines 734–738
- aminosulfones 845, 854–856
- 4-amino-1,2,4-triazine-5-ones 560
- amisulbrom 634, 636, 665, 666, 674, 793
- ammonium thiosulfate (ATS) 575, 577
- anacardic acids 709, 1149
- aniline 110, 152, 402, 686, 687, 689, 752, 757, 834, 926, 943, 951, 1177, 1527, 1552, 1553, 1563
- anilinopyrimidines (APs) 595, 600, 602
 - 4-alkynyl-2-anilinopyrimidines synthesis 751
 - biological activity 752–753
 - chemical and physical properties 750
 - chemistry 749–752
 - degradation and metabolism 757
 - and mechanism of resistance 754–757
 - mode of action 754–757
 - structure–activity relationships 753–754
 - synthesis of 751
- Anthonomus grandis* 1024, 1303, 1465, 1510
- anthracnoses 689, 825, 881, 927, 970
- anthranilic diamide insecticides
 - chemical synthesis 1566–1567
 - discovery of
 - chlorantraniliprole (Rynaxypyr®) 1564–1565
 - cyantraniliprole 1565–1566
 - insecticidal phthalic diamides 1563
 - mode of action 1568–1571
- anti-Oomycete fungicides 871–877
- Aonidiella aurantii* 1058, 1060–1061
- Aphis gossypii* 1146, 1213, 1274, 1285, 1298, 1323, 1336, 1368, 1372, 1517
- Apis mellifera* 1172, 1236, 1344, 1379, 1518

- Aplysia californica* (Ac-AChBP) 1234
 acetylcholine-binding protein 1288
 crystal structure of 1235
 appressoria formation 753, 938
Arabidopsis thaliana 19, 37, 44,
 47–48, 50, 72, 101, 245, 266, 304,
 336, 351, 356, 388, 440, 478, 918
 Arthropod Pesticide Resistance
 Database (APRD) 999–1000
 arylacetic acid amides 734–738, 740
 arylaminopyridines 718
 aryl-and hetarylurea 530
 2-aryl- cyclohexane-1,3-dione
 derivatives 517–519
 2-aryl-cyclopentane-1,3-diones 511–
 517
 2-aryl-1,3-dione (DEN) 501, 510
 Arylex™ 311, 344–347, 433
 6-arylpicolinates
 chemistry of 345
 discovery of 344–345
 herbicidal utility
 Arylex™ 346–347
 Rinskor™ 347–349
 mode of action 345–346
 aryl pyran-and
 piperidine-
 diones 520–524
 2-aryl-pyrazolo-1,3-diones 524–525
 2-aryl-pyridazine-1,3-diones 525
 arylsulfonyl acid amides 739–743
 2-aryl-tetramic acids 519–520
 2-aryl-tetronic acids 519–520
 ATP synthase 624–627, 703, 707,
 1137, 1138, 1140, 1141
 atractyloside 627, 628
 auxin-binding protein 1 (ABP1) 311
 auxin herbicides
 ABP1 311–312
 auxin transporters 312–314
 binding studies 311
 effects of treatment 305
 field resistance 314–315
 indole-3-acetic acid (IAA) 303
in vitro binding assays 309
 molecular MOA 303
 perception and signaling 305–306
 TIR1/AFB auxin receptors 306–310
 weed selectivity 314
 auxins, PGRs 573
 avermectin aglycon derivatives 1490
 avermectin B₁ 1482, 1485, 1490, 1491,
 1592
 avermectins
 chemistry of 1481–1485
 structure 1482–1483
 Avicta™ 1586, 1591–1594
 azafenidin 179
 azimsulfuron 56, 73–75, 77
 azolones 637, 665–667, 673
 azomethine anti-feedant
 pymetrozine 1509
 azoxystrobin 579, 600, 601, 636, 641,
 643, 644, 654, 655, 657, 659, 689,
 1318
- b**
Bacillus firmus 1282, 1586, 1605–1606
Bacillus thuringiensis 1010
 Bollgard 1111
 CAAS 1111
 CaMV 1108
 corn rootworms 1109
 Cry1A 1106
 crystal proteins 1104–1106
 insect resistance to 1114–1115
 KMD 1113
Leucinodes orbonalis 1112
Manduca sexta 1106–1107
Ostrinia nubilalis 1108–1109
 pest control of 1110
 plant engineering 1103–1104
 resistance management 1115
 tobacco plants 1107
Bactrocera cucurbitae 1466
Bactrocera dorsalis 1402, 1466
 Baermann funnels 1649
 Basic Local Alignment Search Tool
 (BLAST) 876, 881
 Basidiomycetes 458, 599, 603, 623,
 635, 666, 688, 689, 696–698, 785,
 797, 798, 801, 836, 1174
 [³H]batrachotoxin-B ([³H]
 BTX-B) 1435

- Battalion® 431
 β-carotene 214, 216, 217, 243
 β-chitin 1068
 β-diketones 749
 beflubutamid 232, 234, 237, 238
Bemisia tabaci 1056–1060, 1074,
 1205, 1252, 1275, 1323, 1336,
 1369, 1375, 1377, 1509, 1510
 bencarbazone 201
 benodanil 681
 benoxacor 274, 278, 429–431, 443
 benthiaivalcarb 845–847, 852–854, 863
 benzamide fungicide 588, 701, 786, 1630
 benzamide nematocides
 mitochondrial complex II inhibitors
 fluopyram mode of
 action 1633–1634
 flutolanil inhibition 1634–1635
 pyridinyl-ethyl benzamide
 fluopyram 1630
 structure and function 1631–1633
 plant-parasitic nematodes
 cucumber 1638
 in fruiting vegetables 1638
 Meloidogyne spp. 1637
 methodology 1637
 in potatoes 1640
 in tobacco 1641
 tomatoes 1638–1640
 benzenedicarboxamides 1541,
 1549–1551, 1553, 1560
 benzfendizone 184–186, 188
 benzimidazoles 189, 190, 589, 592,
 594–596, 599, 600, 706, 707, 709,
 773, 774, 798, 915, 927, 934
 benzobicyclon 254, 261, 271,
 276–278, 367
 benzofenap 291–293, 297, 301
 benzoheteroaryl Protoc herbicides 190
 benzoheterocycles 176, 188–190, 198
 benzoheterocyclic to
 heterocycle 188–192
 benzonitriles
 biological activity 394–395
 chemistry of 392–393
 benzo[1,2,3]thiadiazole-7-carboxylic
 acid 965
 1,2,4-benzotriazine-1-oxides 923
 benzovindiflupyr 684, 688–689
 benzoyl cyclohexane-1,3-dione (CHD)
 herbicides 242
 benzoylphenyl ureas (BPU)
 bistrifluron 1074
 chlorfluazuron 1071
 diflubenzuron 1071
 flucycloxuron 1074
 flufenoxuron 1073
 hexaflumuron 1073
 lufenuron 1073–1074
 NK-17 1074
 novaluron 1073
 noviflumuron 1073
 synthetic routes 1071–1072
 teflubenzuron 1072
 benzyl uracils 192
 best management practices
 (BMPs) 10, 465–467
 β-1,4-glucan accumulation 409
 β-1,4-glucan chains 391
 β-1,3-glucan synthetases 954
 bicyclopyrone 244, 254, 266, 268, 272,
 273, 278–280, 430, 433
 bifenazate
 ecobiology 1188
 physiochemical data 1187
 registration status 1188–1189
 resistance behavior 1189
 structure activity 1183–1187
 structure of 1184
 binapacryl 707, 710, 715
 bionematicide, Votivo™ 1605–1606
 biotin carboxy carrier protein
 (BCCP) 16
 biotin carboxylase (BC) 16, 502
 bisacylhydrazine (BAH) 1013
 commercial activity of
 chromafenozide 1034
 fufenozide 1034
 halofenozide 1034–1038
 methoxyfenozide 1033,
 1038–1039
 tebufenozide 1033
 discovery and structures of
 1016

- bisacylhydrazine (BAH) (*contd.*)
 20E 1028
 ecdysone agonist 1044
 ecdysteroids 1024
 EcR 1024, 1025
 insect molting hormone 1014–1016
 LBD 1025
 lethal effects 1029–1030
 mammalian, ecotoxicology
 data 1041
 mode of action
 insect toxicity of 1031–1033
 lethal effects 1029–1030
 sub-lethal effects 1030–1031
 resistance mechanisms and
 potential 1043–1044
 structure–activity relationship
 (SAR) 1019–1022
 sub-lethal effects 1030–1031
 synthesis of 1017–1019
- bis-aromatic alkynes 399
- bispyribac-sodium 135–137
- bistrifluron 1072, 1074
- bitertanol 812, 1299
- bixafen 601, 683, 689, 1602
- Blattella germanica* 1070, 1457
- bleaching herbicides
 biology and use pattern 233–234
 carotenogenic pathway 219
 carotenoid biosynthesis
 in higher plants 215–217
 HPPD inhibition 214
 plastoquinone 213
 plastoquinone properties and
 function 214–215
 genetic engineering 219
 lycopene cyclase (LCC) 217–218, 454
 phytoene desaturase and ζ -carotene
 desaturase 217
 phytoene desaturase
 inhibitors 234–237
- (E)- β -methoxyacrylates (MOAs) 638
- Bollgard II 1111
- Bombus terrestris* 1039, 1344, 1345,
 1416, 1522, 1536
- Bombyx mori* 1055, 1179, 1237, 1518,
 1538, 1546
- bongkreic acid 628
- Borrelia burgdorferi* 1467
- boscalid 600, 685–688, 690, 699, 700,
 1602
- Brevipalpus phoenicis* 1093
- bromethalin 706, 718
- 2-bromoacetophenone 291, 293
- bromuconazole 819–820
- brood compensation index
 (BCI) 1346
- brood termination rate (BTR) 1346
- β -tubulin 786–787, 789, 792
- Bulinus truncatus* (Bt-AChBP) 1234
- buprofezin 1074, 1075, 1549
- butafenacil 184, 185, 202, 204
- butenolides
 discovery of 1362–1365
 insect vs. vertebrate 1249
 MoA insects 1244
- C**
- Caenorhabditis elegans* 1230, 1456,
 1481, 1593, 1625, 1632, 1648
- Calaris[®] 271, 274
- calcium-induced calcium release
 (CICR) 1542
- CAMIX[®] 275
- Capitella teleta* (Ct-AChBP) 1234
- Capreno[®] 152, 164, 165, 275, 436
- carbamates 231, 374, 404, 410, 411,
 592, 645, 850, 854, 856, 989,
 1010, 1051, 1518, 1588
- carbamoyl isoxazoles 642
- carbamoyl tetrazolinones 363,
 367–369
- carbazate acaricide 1183–1185
 definitions of 1185
 formula of 1184
- carbendazim 600, 785, 788, 789
- carboxamides 327, 367, 589, 696, 896,
 1174, 1175, 1426
- carboxin 599, 623, 681, 690, 700, 1174
- carboxylic acid amide (CAA) 592, 603,
 740, 793, 845–866
- amino acid amides
 aminosulfones 854–856
 benthiavalicarb 852–853

- iprovalicarb 850–852
- N*-sulfonyl amino acid
 - amides 856
 - valifenalate 853–854
- biological activity 862–863
- cinnamic acid amides
 - dimethomorph 847–848
 - flumorph 848–849
 - pyrimorph 849
- glyoxylic acid derivatives 860–862
- mammalian toxicology of 847
- mandelic acid amides,
 - mandipropamid 856–863
- mode of action and mechanism of
 - resistance 863–866
- carboxyltransferase (CT) 16, 502, 1216–1218
- carfentrazone-ethyl 178
- carotenes 215–216
- carotenoid biosynthesis
 - in higher plants 215
 - HPPD inhibition 214
 - plastoquinone 213
 - properties and function 214–215
- carotenoids synthesis 243
- carpropamid 603, 882, 885, 889, 894–897, 899, 1299, 1305
- catalytic subunits (CSU) 36, 617
- cauliflower mosaic virus (CaMV) 1108
- CCMT, synthetic pathways 1278
- cellulose biosynthesis
 - accessory proteins 392
 - acetamides 398–399
 - alkylazines 403–407
 - benzamides 395–398
 - benzonitriles
 - biological activity 394–395
 - chemistry of 392–393
 - bis-aromatic alkynes 399–401
 - β-1,4-linked glucan chain 391
 - cellulose microfibrils 391
 - cellulose synthase complex (CSC) 388
 - CesA proteins 389–390
 - CESTRIN 412–413
 - class-specific region (CSR) 389
 - cobtortin 412
 - commercialized inhibitors, properties of 413
 - coumarins 411–412
 - epopromycins 416
 - in higher plants 387
 - inthomycins 415–416
 - N*-Aryl Lactams 410–411
 - plant-conserved region (PCR) 389
 - primary and secondary cell walls 388
 - sangivamycin 416–417
 - thaxtomins 413–415
 - thiatriazines 407–410
 - triazolocarboxamides 401–403
 - uridine diphosphate (UDP) 389
- cellulose biosynthesis inhibitors (CBIs) 4, 387, 392
- cellulose microfibrils 391, 392, 412
- cellulose synthase complex (CSC) 388
- cellulose synthase interacting protein 1 (CSI1/POM2) 392
- central nervous system (CNS) 706, 993, 1223, 1253, 1255, 1373, 1374, 1433, 1434, 1450
- cereals 62
 - flupyrsulfuron-methyl-sodium 64–65
 - iodosulfuron-methyl-sodium 66–67
 - mesosulfuron-methyl 67–69
 - methiopyrsulfuron 71
 - monosulfuron 71
 - safener mefenpyr-diethyl 67
 - sulfonylurea herbicides 63
 - sulfosulfuron (MON 37500) 65–66
 - tritosulfuron 69–71
- Cestrin 412–413
- C15 farnesyl pyrophosphate (FPP) 215
- C17-forosamine 1407
- CGA 293'343 1317–1331
- CGA 325615 407, 409, 410
- C20 geranylgeranyl pyrophosphate (GGPP) 215
- channel-blocking insecticides
 - semicarbazone sodium 1426
- Chelacaropsis moorei* 1529

- chemical uncouplers 629,
710–714
- chemiosmotic hypothesis 610
- Chilo suppressalis* 1016, 1071, 1113,
1574
- chitin biosynthesis
action mechanism 1069–1070
CHS 1068–1069
cuticular exoskeleton 1067
inhibitors
BPU 1071
buprofezin 1074
cyromazine 1075
polyoxin D 1071
- chitin synthase (CHS) 1068–1069,
1086, 1090, 1094
- Chlamydomonas* 244, 245, 253
- chlorfenapyr 1150, 1152
- chlorantraniliprole (Rynaxypyr®)
biological profile
insecticidal potency and
attributes 1571–1573
IRM method 1574–1575
mammalian and environmental
safety 1573
mechanisms of resistance,
diamides 1575–1577
discovery of 1564–1565
- chlorfenapyr 663, 707, 1146,
1150–1154, 1467
- chlorfluazuron 1071, 1072, 1074
- chloride channel 1592
- chloroacetamides 234, 354, 357–359,
363, 443–444
- 3-chloro-1,2-benzisoxazole-1,1-
dioxide 964
- 2-chlorobenzothiazole 365
- chlorocarbonyl triazolinone 561
- 6-chloro-3-chloromethyl-pyridine
(CCMP) 1296
- chloro-dinitrobenzene (CDNB) 23
(5-chloro-6-ethylpyrimidin-4-yl)(1-
naphthaleno-2-ylethyl)
amine 732
- chloronicotylin insecticides
(CNIs) 885
- 4-chloro-2-pentenamides 192
- chlorophyll biosynthetic
pathway 174–175
- chloroplastic isoform (GS2) 477
- 2-chloro-1,3-thiazol-5-ylmethyl
(CTM) 1276
- 2-chlorothiazol-5-ylmethyl 1387
- 2-chloro-6-
trichlormethylpyridine 234
- 3-chloro-5-trifluoromethyl-2-pyridinyl
residue 695, 696, 698
- chlorthiamid 393
- chordotonal organ TRPV channel
modulators 1502
- Choristoneura fumiferana* 1025, 1032,
1035
- chromafenozide 1016, 1019–1020,
1023, 1031, 1033, 1034
- Chrysoperla carnea* 1121, 1273, 1357,
1536, 1559
- Cinch® 430
- cinidon-ethyl 180–181
- cinnamic acid amides
dimethomorph 847–848
flumorph 848–849
pyrimorph 849
- ¹⁴C-iprovalicarb 863
- Ciral® 64
- 9-*cis*-epoxycarotenoid dioxygenases
(NCEDs) 305
- Clariva™ 1586, 1605, 1606
- clofentezine 1086–1091
- clopyralid 163, 274, 304, 315, 318–322,
324, 325
- cloquintocet-mexyl 432–434
- cloransulam-methyl
crop selectivity 110–111
crop utility 109–110
environmental degradation,
ecotoxicology, and
toxicology 111–112
- clothianidin 1276, 1279, 1281, 1317
chemical classification 1276–1277
physicochemical properties of 1277
spectrum activity 1280
- Cnaphalocrocis medinalis* 1113, 1464,
1563
- COBRA-like proteins 392

- cobtorin 412
 colchicine 787, 789
 comparative molecular field analysis (CoMFA) 1021, 1286, 1297
 complex I inhibition
 aminoalkylpyrimidines
 diflumentorim 729
 structure–activity relationship (SAR) 731
 structure of class 729
 arylacetic acid amides 734–738
 arylsulfonyl acid amides 739–743
 insecticides and acaricides 727
 phenoxan 743
 phenylacetic acid amides 738–739
Conyza canadensis 24, 278, 464
Coptotermes formosanus 1074, 1466
Cosmopolites sordidus 1464
 cotton herbicide 134–135
 coumarins 411–412, 708
 coumoxystrobin 645
 crop baiting system 1465–1466
 cross-resistance 14, 16, 17, 19, 1000
 metaflumizone 1447
 spinosyns 1406
 sulfoxaflor 1348, 1349
 crystal protein (Cry) proteins
 Bt insecticides 1104
 structures of 1106
Ctenocephalides felis 1252, 1467, 1481
 Curcurbit Yellow Stunting Disorder Virus (CYSDV) 1376
Curvularia spp. 839, 1280
 cuticular exoskeleton 1067
 cyanohydroxyiminoacetamides 911
 3-cyanopyrroles 769
 cyantraniliprole (Cyazypyr®) 327, 1565–1566
 biological profile 1577
 discovery of 1565
 cyazofamid 634, 636, 665–667, 670, 673
 cyclic ADP-ribose (cADPR) 1543
 cyclization reactions 216, 965, 1302, 1315, 1316
 cyclohexanediones (CHDs) 16, 253, 258, 259, 262, 287, 501, 508–510
 1-cyclopropyl-butane-1,3-dione 749
 cyclosulfamuron 56, 57, 75–79
Cydia pomonella 1058, 1303–1304, 1331, 1337, 1338, 1413, 1415
 cyenopyrafen 1168–1171
 cyflufenamid
 cross resistance 934–935
 discovery 933–934
 manufacturing process 935–936
 and mode of action 934–935
 cyflumetofen 1171
 development stages 1172
 ecobiology 1172
 registration status 1173
 resistance behavior 1173
 structure of 1171
 synthesis of 1172
 cymoxanil
 chemical structure 912
 commercial usage 912
 host–pathogen interactions 915
 market significance 913
 physico-chemical properties 912
 preventative/curative application 915
 sporulation-inhibiting properties 913
 synthesis 913
 CYP6CM1vQ 1286, 1376–1378, 1382
 cyprodinil 602, 728, 749–750, 752–756, 774, 934
 cyprosulfamide 152, 157, 164, 167, 293, 427, 437, 438
 cyrmenins 638
 cyromazine 1075
 Cys-loop receptor (CLR) 1233, 1455
 cystathionine- β -lyase (CBL) 755
 cyst nematode 1282, 1585, 1594, 1600, 1606, 1615, 1636, 1651
 cytochrome-P450-dependent monooxygenases 1509
 cytochrome-P450 monooxygenase system 21
 cytokinins, PGRs 574
 cytoplasmic male sterility (CMS) 457
 cytosolic isoform (GS1) 477

d

- Daminocide 577
Danaus plexippus 1120
Daphnia magna 542, 1347, 1492, 1494
 DCJW 1432–1436, 1447
Delia coarctata 1465
 demethylation inhibitors (DMIs) 574, 592, 664, 798
 density functional theory (DFT) 893, 1287, 1362, 1363
 1-deoxy-D-xylulose-5-phosphate (DOXP) 215
Dermatophagoides farinae 1528
 D-glufosinate 488
 diafenthiuron
 acute toxicity 1139
 biological activity 1144–1146
 crop protection 1144–1146
 mode of action 1139–1141
 structure–activity relationship (SAR) 1142
 toxicology and ecotoxicology 1144
 diamide-resistant *P. xylostella* 1575
 diamides insecticides
 anthranilic 1562
 binding site and target-site resistance 1545
 chemical structures 1541–1542
 mode of action 1543–1545
 diarylamines 708, 710, 717–719
 diaryl-tetrazines 1087
 dicamba 25, 152, 163, 166, 167, 274, 308, 456, 459–462, 468, 469, 472, 473
 dicamba resistant (DR) trait
 DMO transformation, in soybean 461–462
 field evaluation, stacked soybeans 462–464
 identification 459–461
 dicarboximides 761–766
 dichlobenil 392–395, 402, 407, 411
 dichlormid 429, 431, 443
 dichloroacetamide 443
 dichloroacetamide safeners
 benoxacor 429–430
 dichlormid 431
 2,6-dichlorobenzonitrile 392
 diclomezine
 chemical structure 921
 and ecotoxicological profile 923
 physico-chemical properties 922
 rice sheath blight 922
 synthesis of 921
 toxicological 923
 diclosulam
 crop selectivity 110
 crop utility 109–110
 ecotoxicology 111–112
 environmental degradation 111–112
 metabolism of 110
 and toxicology 111–112
 dicyclomet 882
 dieldrin 1452–1454
 diethofencarb 599, 600, 788, 789, 792
 DiFlexx[®] 437
 diflovidazin 1086–1094
 diflubenzuron 1069–1071, 1075, 1076
 diflufenican 67, 218, 222, 233, 365
 diflumetorim 728–730, 734, 738, 1175
 1,4-dihydro-1-phenyl-5H-tetrazol-5-thiones 1143
 dihydropicrotoxinin 1451, 1452
 dihydropyrazoles 1433–1437
 1,8-dihydroxynaphthalene (DHN)
 melanin 879
 biosynthetic pathway 879–881
 carpropamid 896–897
 fungicidal activity 881
 heavy metals 881
 polyketide synthase (PKS) 882, 883
 scytalone dehydratase (SD) 886
 computational investigations, of enzyme mechanism 891–893
 and inhibitor structures 893–896
 site-directed mutations 896
 X-ray structures and active site 889–891

- 1,3,6,8-tetrahydroxynaphthalene reductase 885
- tolprocarb
 biological activity 902–904
 inhibiting PKS activity 898–900
 structure–activity relationships 900–902
- 3,4-dihydroxyphenylalanine L- (DOPA) 879
- dihydroxyxanthenone formation 258
- diketoneitrile (DKN) 244, 286, 294, 295
- dimefluaazole 667
- dimethomorph 793, 845, 847, 855, 862–864, 871
- 1,3-dimethyl-5-pyrazolon 289, 290, 298
- Dinamic® 564
- dinitroresol (DNOC) 706
- dinitrophenols 706, 708, 715, 718, 1156
- dinobuton 715
- dinocap 706, 707, 715
- dinotefuran 1282, 1284
 chemical classification of 1282–1283
 physico-chemical properties 1283
 spectrum activity 1285
- diones 259, 262
- dioxapyrrolomycin 1149, 1150
- diphenylalkanoylaminopyridines 734
- diphenyl ether herbicides 176
- diphenyl-oxazolines 1097
- 4,6-disubstituted pyrimidines 750
- dithiopyr
 biology 494
 synthesis 497–499
- dorsal unpaired median (DUM) 1433, 1456
- D1 protein 15, 214, 244
- DPX-JW062 1427
- drazoxolon 716
- Drosophila*
D. melanogaster 1024, 1025, 1070, 1237, 1347, 1350, 1405, 1453, 1481, 1544, 1568, 1648
nAChR subunits 1231, 1232
Drosophila α -subunit (SAD) 1252
Drosophila Kc cells 1016, 1023
 Dual-II-magnum® 430
Dysdercus cingulatus 1463
- e**
- ecdysone agonist, BAH 1044
- ecdysone receptor (EcR) 1013, 1021, 1024
 ligand binding domain (LBD) 1025
- ecdysteroids 1013, 1016, 1019, 1021, 1024, 1025, 1027, 1028
- Echinochloa* spp. 13, 81, 82, 115, 137–139, 147, 367, 382, 494
E. crus-galli 73, 109, 115, 117, 134, 166, 364, 376, 401
E. oryzicola 137–139, 145, 276, 380
- ecotoxicology 542–544, 547, 872–873, 985–986, 1144
- emamectin
 benzoate 1146, 1478, 1480, 1482, 1491, 1492, 1495, 1496, 1544, 1554, 1557
 mites and insects 1491
 synthesis of 1484
- endo-/sarcoplasmic reticulum (ER/SR) 1541
- enestroburin 635, 645
- 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) 338, 454, 532
 glyphosate 20
- Envidor®, ACCase 1211–1212
- environmental toxicology
 aquatic nontarget species 1347
 terrestrial nontarget species 1343–1347
- Ephestia kuehniella* 1121
- epopromycins 416
- epoxiconazole 579, 816–819
- ergosterol biosynthesis 797, 799–801, 833
- Erwinia chrysanthemi* 1233
- ethaboxam 600, 786, 788, 791, 792
- ethoxysulfuron 56, 73, 75–76, 436
- ethylene, PGRs 573

- ethyl 2-(4-fluoro-3-trifluoromethylphenoxy)butanoate 238
- etoxazole 1085–1101
- European and Mediterranean Plant Protection Organisation (EPPO) 542
- f**
- fatty acid synthase (FAS)
inhibitor 353, 503, 882
- feeding blockers
biological activity and use
recommendations of 1517
- flonicamid
biological mode of action 1516
discovery of 1512
resistance 1517
synthesis of 1512–1516
- IRAC 1502
- pymetrozine
chemical and physical properties
of 1506
discovery 1502–1505
- pyridine azomethines 1506
- synthesis 1506
- pyrfluquinazon
chemical and physical properties
of 1521
discovery of 1518–1519
synthesis of 1520–1521
- fenamistobin 635, 645
- fenazaquin 663, 727, 743, 1138, 1163,
1165–1166, 1192, 1194
- fenbuconazole 814–816
- fenclorim 444
- fenfuram 681, 685
- fenhexamid 595, 602, 604, 833–837,
839
- fenoxanil 882, 885, 886, 894–896
- fenoxaprop-*p*-ethyl 435
- fenoxasulfone
biological activities 381–382
chemistry 380–381
commercial products 382
mode of action 383
physicochemical properties 382
- fenpiclonil 764
chemical and physical
properties 770, 771
Knoevenagel condensation 769
production processes 769
synthesis 769
- fenpyrazamine 602, 835–839
- fenpyroximate 614, 663, 1141,
1163–1164
- fentrazamide 148, 271, 272, 276, 357,
358, 363, 365–371
- ferimzone 715–717
- fipronil
chemical and physical properties
of 1460, 1598–1599
degradation of 1469
- flavin adenine dinucleotide (FAD) 33,
36, 609, 621, 1632
subunit structure 37, 38
- Flexity® 939
- flonicamid 1501–1502
aphicidal spectrum of 1517
biological mode of action 1516
chemical and physical properties
of 1516
resistance 1517
safety profile 1518
synthesis of 1512–1516
target sites 1516–1517
- florasulam
crop selectivity 110–111
crop utility 110
ecotoxicology, and toxicology 112
environmental degradation 112
metabolism of 111
- fluacrypyrim 635, 663, 1175, 1182,
1192, 1195
- fluazaindolizine 1586, 1603–1604, 1643
biological profile 1649–1652
chemical nomenclature 1646
classification 1646
ecotoxicological profile 1646, 1648
mode of action 1647–1649
nematicidal symptoms 1647–1649
N-phenylsulfonylimidazopyridine-2-
carboxamide lead
compound 1644

- physical-chemical properties 1646
- RKN 1645
- structure of 1644–1646
- toxicological endpoints 1646–1647
- fluazinam 706–708, 718–719
- fluazolate 179, 195, 197
- flubendiamide
 - chemistry
 - beneficial arthropods 1558
 - 1,2-benzendicarboxamide derivatives 1551
 - cross-resistance 1558
 - fast-acting activity 1554–1558
 - lepidopterous pests 1554
 - persistence 1554
 - structure–activity relationship (SAR) 1553
 - toxicological profile 1558–1559
 - X-ray structural analysis 1553
 - history of invention 1549–1550
- flucarbazone-sodium 151, 153, 162
- flucetosulfuron 56, 57, 78–80
- fludioxonil
 - biokinetic data, for grape berries treatment 773
 - biological mode of action 776
 - chemical and physical properties 770, 771
 - in vitro* activity spectrum 771, 772
 - production processes 769
 - seed-treatment purposes 775
 - synthesis 770
- fluensulfone (NimitzTM)
 - biological lab and field activity 1600
 - chemical and physical properties 1598–1599
 - discovery 1594–1597
 - ecotoxicity profile 1601–1602
 - fluoroalkenyl group 1594
 - mode of action 1599–1600
 - safety profile 1601–1602
 - structure–activity profile 1597–1598
 - synthesis of 1598
 - use recommendation 1600–1601
- flufenacet 293, 355, 356, 360, 363–366, 371
- flufenoxuron 1073, 1544, 1554, 1556
- flufenpyr-ethyl 184–186
- flumetsulam 18, 19, 107, 123
- flumiclorac-pentyl 180, 181
- flumorph 845, 848–849, 864
- fluopicolide 695
 - chemical and physical properties 871–872
 - P. infestans*, effect on zoospores and mycelial growth of 873–874
 - spectrin-like protein distribution 874–877
 - in *P. infestans* by bioanalysis 876–877
 - toxicology/ecotoxicology 872–873
- fluopyram 689, 694–701, 1299, 1586, 1602–1603, 1630–1642
- fluopyram SC400 (Velum[®]) 1636–1641
- fluoroalkenyl nematicides 1597–1598
- fluoxastrobin 643, 652, 655, 657, 659, 671, 827, 828, 925
- flupoxam 392, 401–403
- flupropacil 184, 185
- flupyradifurone
 - biological profile of 1374–1375
 - CYP6CM1vQ 1377–1378
 - discovery of 1365–1370
 - laboratory synthesis 1366
 - physico-chemical properties 1369–1370
 - structure–activity relationship (SAR) 1368–1369
 - honey and bumble-bees safety 1379–1381
 - mammalian safety profile 1378–1379
 - mode of action 1373–1374
 - nontarget arthropods 1379
 - physicochemical properties 1370
 - plant uptake and translocation 1370–1373
 - speed of action, feeding cessation 1372–1373
 - synthetic pathways 1366
 - virus vector control 1376

- flupyrsulfuron-methyl-sodium (DPX-KE459) 64
- fluquinconazole 753, 824–825
- flurazole 430, 442–443
- fluridone 225–227, 233–234, 237, 243
- flurochloridone 226, 233–234, 237
- flurtamone 223, 225–227, 233, 234, 237
- flusulfamide
- chemical structure 919
 - market significance 920
 - physico-chemical properties 919–920
 - synthesis scheme 920
- flutenzine 1086–1091
- flutianil 933, 943–945
- flutolanil 623, 685, 696, 1174, 1176, 1630, 1634–1635
- fluxapyroxad 689, 699, 1602
- fluxofenim 430, 432, 433, 442–443
- Folicur[®] 813
- foramsulfuron 56, 58, 82–84, 436, 446, 534
- fosetyl-aluminum
- chemical structure 915
 - foliar application 916
 - gene-expression changes 918
 - glucose metabolism 918
 - physicochemical properties 916
 - toxicological profile 917
- Frankliniella* spp. 1297, 1464–1465
- F. occidentalis* 1219, 1405, 1492, 1494, 1535
- fthalide 882, 885
- fufenozide 1016, 1019, 1021, 1034
- 4-fumarylacetoacetate lyase 243
- fumigant nematicides 1587–1588
- fungicide
- amino acid and protein synthesis 602
 - cell wall biosynthesis 604
 - classification 598–607
 - cytoskeleton and motor proteins 600
 - with FRAC serial number and unknown mode of action 606
 - fungal respiration 601
 - Fungicide Resistance Action Committee (FRAC) 596
 - global market 592–593
 - history of usage 589–590
 - host plant defence induction 605
 - lipid synthesis and membrane integrity 603
 - mechanisms and occurrence 593–595
 - melanin synthesis, in cell wall 605
 - mode of action 590–593, 598–607
 - multisite mode of action 607
 - nucleic acid synthesis 599
 - practical resistance, occurrence of 594
 - resistance management and risk modifiers 597–598
 - resistance risk assessment 597
 - signal transduction 602
 - sterol biosynthesis 604
- Fungicide Resistance Action Committee (FRAC) 587, 590, 596, 664, 756, 778, 787, 802, 845, 938, 955, 959, 996
- classification 802
- furametpyr 685, 690, 691, 1176
- furilazole 429, 431, 432
- Fusarium* spp. 590, 599, 601, 716, 743, 771, 774, 775, 820, 821, 828, 1119, 1642
- F. moniliforme* Sheld 574
- g**
- GABA-gated cation channel 1230, 1456
- insect GABA receptor
- cloning 1453–1454
- γ -aminobutyric acid (GABA) 993, 1189, 1389, 1450, 1481, 1592
- biological properties
- biological spectrum 1463–1464
 - crop baiting system 1465–1466
 - foliar applications 1465
 - seed treatment 1464–1465
 - soil applications 1464
- chemistry

- structure–activity relationship 1461–1463
 - synthesis of fiproles 1458–1461
 - ethiprole 1450
 - fiprole insecticides 1449
 - fipronil 1449–1450
 - mode of action 1450–1458
 - receptor, insecticide target site 1451–1453
 - resistance and management 1467–1468
 - γ -chitin 1068
 - gene expression 353, 355, 379, 438, 440, 441, 685, 762, 877, 918, 961, 962, 969–975, 1045, 1104, 1212
 - gibberellins, PGRs 573–574
 - Global Diamide Working Group (WG) 1574
 - Gloeobacter violaceus* 1233
 - glufosinate 164, 451, 452, 454, 456, 463, 472, 473, 477, 482–488
 - glutamate-gated chloride channels (GluCl_s) 993, 1230, 1400, 1450, 1454, 1456–1457, 1478–1497, 1592, 1648
 - agriculture, use in 1495–1497
 - allosteric modulators 1478, 1481
 - avermectins, chemistry of 1481–1485
 - market products names and codes 1479 properties 1480
 - milbemycins, chemistry of 1485–1488
 - mode of action 1480–1481
 - safety and bioavailability 1492–1494 and environment 1495
 - glutamine synthetase (GS) inhibitors 532
 - herbicidal activity, of phosphinothricin in agriculture and horticulture 484 crop selectivity 484–487 environmental conditions 483 herbicidal symptoms 482 herbicide resistance 488
 - N*-acetyl-
 - phosphinothricin 487–488
 - physiological effects 482–483
 - uptake and translocation, of glufosinate-ammonium 483–484
 - L-phosphinothricin 476, 481
 - phosphinothricin 479–480
 - plant nitrogen metabolism 477–479
 - tabtoximine- β -lactam 476
 - glutathione (GSH) 21, 23, 439, 443–445, 915
 - glutathione S-transferase (GST) 360, 438–440, 444, 446, 967, 1025, 1173, 1576
 - metabolic detoxification 21–24
 - glycine-gated chloride channels 1457
 - glyoxylic acid derivatives 845, 860–862
 - glyphosate 5, 7, 10, 13, 14, 20, 24–26, 47, 50, 51, 84, 164, 174, 203, 245, 278, 331, 334, 347, 451–473, 484, 487, 1110
 - N*-phosphonomethyl glycine 454
 - glyphosate-resistant 13, 20
 - Golden Crownbread (*Verbesina encelioides*) 325
 - green chemistry 1041, 1283, 1402, 1404, 1419, 1552
 - growth inhibitors, PGRs 574
- h**
- halofenozide 1016, 1017, 1022–1024, 1028, 1029, 1032–1038
 - Harmonia axyridis* 1179, 1353, 1357, 1518, 1536, 1559
 - haustoria formation 753, 938, 954
 - Helicoverpa* spp. 1414, 1531
 - H. armigera* 997, 1036, 1105, 1154, 1298, 1437, 1496, 1535, 1555
 - H. zea* 1036, 1106, 1294, 1481, 1496

- Heliothis virescens* 1021, 1026, 1036, 1105, 1106, 1111, 1115, 1117, 1119, 1149, 1244, 1251–1253, 1255, 1298, 1322, 1361, 1409, 1447, 1459, 1488, 1496, 1535, 1544, 1568, 1570
- Heliothis virescens* ecdysone receptor (HvEcR) 1027, 1028
- LBD 1021, 1022, 1028
- herbicide resistance (HR) 488
- definition 10
 - multiple resistance mechanisms 25–27
 - nontarget-site mechanisms
 - enhanced metabolic detoxification 21–24
 - herbicide distribution 24–25
 - population evolution 10–14
 - target-site mechanisms
 - ACCase inhibitors 15–18
 - ALS/AHAS inhibitors 18–20
 - EPSPS 20
 - PPO 20–21
 - PS II inhibitors 15
 - weed control
 - agricultural regions 5–6
 - chronological increases 5, 7
 - weed survey 5–28
- Herbicide Resistance Action Committee (HRAC) 359
- classification scheme 529
 - classification system 7–10
 - members, organization and tasks 27–28
 - missions and goals 27
 - multiple resistance
 - mechanisms 25–27
 - non target-site resistance
 - mechanisms 21–24
 - population evolution, IWM 10–14
 - target-site resistance
 - mechanisms 14–21
- herbicide resistant (HR) crops
- best management practices (BMPs) 465–467
 - dicamba resistant (DR) trait
 - DMO transformation, in soybeans 461–462
 - field evaluation, stacked soybeans 462–464
 - identification 459–461
 - disease control benefits 458–459
 - field performance, of weed control systems 470–472
 - glyphosate resistant (GR) trait
 - AMPA 455
 - development of 455–456
 - EPSPS 454–455
 - integrated weed management (IWM) 465–467
 - mechanism 451–452
 - metribuzin 469–470
 - roundup hybridization system 456–458
 - Roundup Ready Plus® (RRP) Program 467
 - weed resistance 464–465
- heteroarylmethylamines 739–473
- Heterotermes tenuis* 1464
- hexaflumuron 1073, 1074
- hexythiazox 1091–1094
- field applications 1096
 - synthetic pathways 1095
- HGA phytyltransferase (HPT) 243, 244
- HGA solanesyltransferase (HST) 243
- Hill reaction 126, 406, 530
- histamine-gated chloride channel 1230, 1455, 1457
- histidine kinases 761–764
- Hordeum leporinum* 24
- host defense inducers
- genetically modified (GM) crops 960
 - induced resistance
 - biochemical changes 962
 - endogenous phytohormones 960
 - priming 963
 - signal perception and transduction 962
 - systemic acquired resistance 961
- market products
- acibenzolar-S-methyl 964–967
 - isotianil 967–975
 - probenazole 963–964
 - tiadinil 967

- house dust mites 1527–1529
- 5-HT₃ (serotonin type 3)
receptors 1455
- Hussar[®] 67, 435
- hydramethylnon 1183
- 1,4-hydroxyanilide fungicides 834
- hydroxyanilides 833–836
- 20-hydroxyecdysone (20E) 1013
BAH 1028–1029
chemical structures of 1014
insect molting
hormone 1014–1016
- hydroxyethyl-ThDP (HETHDP)
AHAS 34
binding site AHAS 41
- 2-(4-hydroxy-3-methoxy)
phenethylamine 857
- 2-hydroxy-[N-(4-fluorophenyl)-N-
isopropyl] acetamide 365
- 2-hydroxy-[N-(methyl)-N-phenyl]
acetamide 365
- 4-hydroxyphenyl-pyruvate 214
- hydroxyphenylpyruvate dioxygenase
(HPPD)
in *Arabidopsis* 241, 243, 244
benzoyl cyclohexane-1,3-dione
(CHD) herbicides 241
carotenoids synthesis 243
heterocycles
benzofenap 291–293
isoxaflutole (IFT) 293–295
pyrasulfotole 297–298
pyrazolynate
(pyrazolate) 288–290
pyrazoxyfen 290–291
tolpyralate 298–299
topramezone 296–297
inhibition 248–250
photosynthetic organisms 242
PQ 242–243
selectivity 244–245
structure and mechanism 245–247
tyrosine degradation pathway 242,
243
- 4-hydroxyphenylpyruvate dioxygenase
(HPPD) 3, 164, 214, 255, 365
- hyperecdysonism 1029
- i*
- imazamethabenz methyl 97, 98, 102,
103
- imazamox 99, 101–103
- imazapic 99, 101–103, 441, 442
- imazapyr 18, 41, 98–103, 128, 140,
141
- imazaquin 19, 44, 45, 50, 98, 99, 102,
103
- imazethapyr 46, 99–103
- imibenconazole 825–826
- imidacloprid (IMI) 1241, 1293, 1350,
1389
biological activities of 1284
chemical classification 1295–1296
homoptera pest insects 1298
lepidoptera pest insects 1298
physicochemical
properties 1295–1296
synthetic pathways 1294
- imidazoles 402, 670, 803, 806–812,
889, 1462, 1482, 1502
- 2,4,5-imidazolidinetriones 197
- imidazolinone herbicides
commercial uses of 103–104
history of 96–98
metabolism of 102–103
mode of action 100
physico-chemical properties 98
structural features of 98–100
structure of 95–96
synthesis method 96
tolerant crops 101–102
- imidazolinone-tolerant crops
101–102
- indaziflam 392, 404, 405, 407, 413,
414
- indole-3-acetic acid 303, 318
- indole-acetic acid (IAA) 336, 573
- indoxacarb
DCJW 1433–1435
and dihydropyrazoles 1433–1435
discovery of 1427–1429
insecticidal activity 1429–1431
mammalian vgSCs 1435–1436
mode of action
and dihydropyrazoles 1433–1435

- indoxacarb (*contd.*)
 - mammalian vgSCs 1435–1436
 - proinsecticide action 1432–1433
 - physico-chemical properties 1430
 - product 1430
 - proinsecticide action 1432–1433
 - resistance 1436–1437
 - vgSCs 1431–1432
- inositol hexaphosphate (IP6) 306
- inositol 1,4,5-trisphosphate receptor (IP3 receptor/IP3R) 1541
- insect growth regulator (IGR) 544, 1049, 1053, 1073, 1074, 1156, 1303, 1346, 1436, 1574
- Insecticide Resistance Action Committee (IRAC) 1468, 1501
- acaricide pyflubumide 1180–1181
- action classification of 1002
- activities
 - APRD 999–1000
 - education and communication 999
 - MSU 999–1000
 - resistance management regulatory 998–999
 - resistance-monitoring methods 998
- compound rules 1001–1008
- Global Diamide Working Group (WG) 1574
- IRM strategies 1009–1010
- market trends 1010–1011
- mode of action
 - classification 1000
 - compound rules 1001, 1008
 - subgroups 1008–1009
- objectives of 996
- resistance management 1000–1001, 1008
- resistance principles
 - nontarget-site resistance 1001
 - target-site resistance 1000
- structure and organization of 996–997
- sub-groups 1008–1009
- insecticide resistance management (IRM)
 - programs 1574–1575
 - strategies 1009–1010
 - virus vector control 1376
- insecticide resistance, progression of 995–996
- insect molting hormone
 - BAH 1013
 - 20E 1013, 1014
- insect vs. vertebrate
 - butenolides 1249
 - mesoionic insecticides 1249
 - neonicotinoids 1247–1248
 - spinosyns 1244, 1248
 - sulfoximines 1248
- integrated pest management (IPM) 1090, 1501, 1530, 1646
 - Envidor[®] 1211–1212
 - Oberon[®] 1211–1212
- integrated weed management (IWM) 10, 13–14, 338, 465–467
- International Survey of herbicide-resistant weeds 5, 26, 27
- inthomycins 415–416
- invertebrate γ -aminobutyric acid 1481
- iodosulfuron-methyl-sodium (AE F115008) 56, 63, 66–69, 82–84, 435, 441, 446
- ionophores 704, 1070
- ionotropic GABA receptor 1455
- ipconazole 821–824
- ipfencarbazone 358, 363, 368–371
- ipfentrifluconazole 829
- iprovalicarb 845, 850–853, 855, 862–865, 871, 876
- isofetamid 689
- isopyrazam 689
- isotianil 959, 969, 972–974
 - disease control spectrum of 970
 - gene expression 975
 - profiling experiments 969–975
 - synthesis 968
 - systemic acquired resistance 968–969
- isoxaben 392, 395–398, 400, 402, 403, 407, 411, 413, 414

- isoxadifen-ethyl 82–84, 152, 157, 164, 167, 245, 275, 436, 446
- isoxaflutole (IFT) 164, 165, 244, 254, 292–296, 298, 437, 438, 564
- isoxazoles 295, 296, 299, 642
- isoxazolines 373
- fenoxasulfone 380–383
- pyroxasulfone 374–380
- Ixodes scapularis* 1467
- j**
- jasmonic acid (JA) 579, 961, 964, 967
- juvenoids 1049–1050
- chemical structures of 1050–1051
- 4-phenoxyphenyl 1051–1052
- synthetic 1050–1051
- target insects 1051–1052
- k**
- Ketospiradox 264
- Korrigan 392, 409
- kresoxim-methyl 595, 600, 637, 642, 644, 652, 653, 656, 659, 661, 1175
- l**
- labeled crops and use patterns 1537
- Lactuca serriola* 18, 19, 49
- Laodelphax striatellus* 1285, 1286, 1298, 1394, 1454, 1510
- Leotiomyces* 881
- lepidine 743, 744
- lepidoptera pests 1030, 1298, 1495
- Lepidosaphes ulmi* 1211
- lepimectin, synthesis of 1487
- Leptocoris* spp. 1465
- L. decemlineata* 1016, 1029, 1032, 1073, 1247, 1281, 1303, 1323, 1446, 1465, 1491
- Leucinodes orbonalis* 1112
- Lexar[®] 273
- ligand-binding domains (LBDs)
- EcR 1026
- HvEcR 1021, 1022, 1026, 1028
- ligand-gated chloride channel homolog 3 (LCCH3) 1455, 1456
- ligand-gated chloride channel structure
- binding site, structure 1457–1458
- channel block, mechanism 1457
- GABA receptors 1455–1456
- glutamate-gated chloride channels 1456–1457
- light-harvesting-complexes (LHCs) 214
- Linepithema humile* 1465–1466
- Liriomyza* spp. 1535–1536
- Locusta migratoria* 1024, 1249, 1506
- Lolium* spp.
- L. multiflorum* 16, 20, 22, 67, 82, 162, 464–465
- L. rigidum* 13, 16–18, 20, 22, 23, 25, 26, 49, 67, 359, 360, 376, 465, 507
- Lotka-Volterra predator-prey model 1607
- L-phosphinothricin 481, 486
- lufenuron 1073, 1074
- Lumax[®] 273
- Lumbriconercis heteropoda* 1229
- Luna[®] 701
- lycopene cyclase (LCC) 217–218, 454
- Lygus* spp. 1355, 1357, 1465, 1517
- Lymnaea stagnalis* (*Ls*-AChBP) 1233, 1268, 1297
- m**
- maize 82–84
- safener isoxadifen-ethyl 82–84
- sulfonyleurea herbicides 82
- maleic hydrazide (MH) 574
- malonoben 708–710
- mandelamide 857–860
- bioisosteres 860
- mandelic acid amides 845
- mandipropamid 856–860
- mandestrobin 644, 645, 672
- mandipropamid 845, 856–860, 863–865
- Manduca sexta* 1055, 1068, 1106–1107, 1249, 1432, 1447, 1488, 1491
- MBI-D fungicides (MBI-Ds) 882, 885, 889, 896, 904, 905
- mectins 1592, 1593
- mefenacet 363–366, 371

- mefenpyr-diethyl 67, 69, 152, 157, 167, 297, 298, 427, 428, 434–435, 437, 441, 444–446
- mefentrifluconazole 829
- melanin biosynthesis inhibitor (MBI) fungicides
- DHN biosynthetic pathway 882–888
- scytalone dehydratase inhibitors 882, 885, 889
- melanin synthesis 603, 605, 879–906
- Meligethes aeneus* 1303, 1510
- membrane permeability transition (MPT) 704
- menadione 703
- mepanipyrim 728, 749, 750, 752, 754
- mepronil 685, 696, 1176
- meptyldinocap 707, 715
- mesoionic insecticides
- biological profile 1393–1395
- chemical synthesis 1388–1389
- discovery of 1385–1386
- ³H-IMI 1390
- IMI 1389–1390
- initial optimization of 1386–1388
- insect vs. vertebrate 1249
- mammalian, environmental safety 1395–1396
- mechanism of 1393
- mode of action 1244, 1389–1393
- nAChR 1392
- P. americana* 1390
- mesosulfuron-methyl 56, 63, 67, 69–70, 435, 441, 445, 446
- metabolic pathway 87, 89
- mesotrione 248, 275
- in planta metabolism 273
- in soils 273
- technical synthesis 274
- meta-biphenyl carbazates 1186
- metabolic detoxification
- cytochrome-P450 monooxygenase system 21
- glutathione-S-transferase 21
- GST 23
- HPPD-inhibitors 24
- L. rigidum* 22, 23
- Peldon Al and Lincs El 23
- metabolic fate, sulfonylureas 87–88
- metabolism
- hydrolysis 1468, 1470
- photolysis 1468, 1469
- soil degradation 1470
- transport and metabolism 1470
- metabolite 1,2-benzothiazole-3(2*H*)-one-1, 1-dioxide (BIT), 964
- metabolite 4-methyl-1,2,3-thiadiazole-5-carboxylic acid 968
- metaflumizone 1446–1447
- chemical structures of 1440
- cross-resistance potential 1447–1448
- initial synthetic methodology 1440–1441
- insecticidal activity 1446
- mode of action 1446–1447
- N*-phenylpyrazoline isomer 1441
- pyrazoline isomers 1441
- metalaxyl 876, 917, 918, 934, 949, 954–956
- metalaxyl 3 949, 950, 954
- metalaxyl-M 950
- biological activity 954
- chemical and physical properties 952
- chemistry of 949–953
- degradation and metabolism, of enantiomers 956
- enantioselective catalysis 953
- invention pathway of 950
- mode of action and mechanism of resistance 954–956
- synthesis of 951
- metamitron 530, 549, 558, 560
- Metaseiulus occidentalis* 1492
- meta-substituted biphenyl carbazates 1186
- metazosulfuron 56, 81
- metconazole 574, 820–823
- methiopyrsulfuron 71, 72
- methoxyacrylate fungicides 1518
- methoxyacrylate pharmacophore 670, 1518

- methoxycarbamate 645, 654, 659
- methoxy carbamate
 pharmacophore 645
- 3-(2-methoxyethoxy)-2-methyl-4-(methylsulfonyl)benzoic acid 299
- methoxyfenozide 1017–1018, 1035, 1038–1039
 BAH 1034
 environmental fate 1039–1041
 metabolism 1039–1041
- 4-[(methylamino)]-2-(5*H*)-furanone 1362, 1363
- methyl benzo[1,2,3]thiadiazole-7-carboxylate 965
- methyl salicylate (MeSA) 961, 966, 974
- 2-methyl-6-solaneyl-1,4-benzoquinone (MSBQ) 243
- metolachlor 355, 359, 360, 375, 376, 429–431, 443, 564, 949, 950
- metominostrobin 637, 642, 655, 657–659
- metrafenone 937
 cross resistance and mode of action 938
 fungicidal profile 938
 manufacturing process 938
 registration, products, formulations and crops 939
- metribuzin 15, 163, 365, 469–473, 530, 549, 560, 564
- microtubulin assembly inhibitor (MAI)
 dithiopyr
 biology of 494
 environmental fate 495
 synthesis 497–499
 mode of action 496–497
 thiazopyr
 biology 494–495
 environmental fate 495
 synthesis of 497–499
 toxicology 495–496
- milbemectin 1480
 crop protection 1497
 mites and insects 1491
- milbemycins
 chemistry of 1485–1488
 structure 1486
- mite growth inhibitors
 clofentezine 1086–1091
 developmental stages 1086
 diflovidazin 1086–1091
 etoxazole 1094–1101
 hexythiazox 1091–1094
 structures of 1086
- miticide benzoximate 934
- mitochondrial electron transport (MET)
 complex I
 fenpyroximate 1163–1164
 pyridaben 1164–1165
 pyrimidifen 1168, 1169
 tebufenpyrad 1166, 1167
 tolfenpyrad 1166, 1168
 complex II cyenopyrafen 1168, 1170, 1171
 complex III
 acequinocyl 1181–1182
 experiment 1189–1193
 fluacrypyrim 1182
 hydramethylnon 1183
 resistance mechanisms 1194
- mitogen-activated protein kinase kinase
 kinases (MAPKKs) 761
- mitogen-activated protein kinases 963
- mixed function oxidases (MFOs) 102, 1150, 1151, 1154, 1471
- modern agriculture, PGRs
 fruiting and growth 577
 fruit storage and ripening 577
 growth inhibitors 574–576
 growth promotion 576
 plant regulators in 575
 sprout inhibition 578
 stress defense 578–580
- Molecular dynamics (MD)
 calculations 36, 504, 891, 1377
- mollusc AChBPs 1236
- Monomorium pharaonis* 1466
- monosulfuron 56, 71–72
- monosulfuron-ester 56, 72
- morpholines 829–831, 934
- MRL regulation 544
- multidrug resistance mechanism 764, 773

- multiple resistance 14, 25–26, 597, 773, 918, 1146
- Musca domestica* 1053, 1237, 1247, 1284, 1286, 1373, 1374, 1406, 1463
- Mutation dependent
- Biomacromolecular Quantitative Structure Activity Relationship (MB-QSAR) 47
- myxothiazols 616, 617, 638, 652
- Myzus persicae* 1099, 1212, 1213, 1216–1219, 1244–1246, 1248–1250, 1252, 1274, 1275, 1299, 1321, 1323, 1336, 1340, 1341, 1350, 1361, 1365, 1369, 1372, 1373, 1389, 1390, 1453, 1506, 1519
- n**
- N*-acetyl-phosphinothricin 486, 487
- nAChR
- butenolide 1244
 - mesoionic insecticides 1244
 - neriestoxin and analogues 1242
 - spinosyns 1243–1244
 - sulfoximines 1244
- N*-amino heterocycles 1502
- N*-amino triazolinones 562
- 1,8-naphthalic anhydride (NA) 427, 442–443
- N*-aryl lactams 410–411
- nematicides
- abamectin (Avicta™)
 - biological activity 1593–1594
 - mode of action 1592–1593
 - biological 1586
 - bionematicide
 - Clariva™ 1606–1607
 - Votivo™ 1605–1606
 - carbamates 1588–1591
 - in development
 - fluazaindolizine 1603–1604
 - tioxazafen 1604–1605
 - fluensulfone (Nimitz™)
 - 1594–1602
 - fluopyram 1602–1603
 - in markets 1587
 - organophosphates (OPs) 1588–1591
 - soil fumigant 1587, 1588
 - spirotetramat 1607–1608
- neonicotinoids 1242–1243, 1248, 1268, 1501, 1510
- five-membered ring systems
 - imidacloprid 1293–1300
 - thiacloprid 1300–1305
 - insect vs. vertebrate 1247
 - mode of action insects 1242–1243
 - noncyclic neonicotinoids
 - acetamiprid 1273–1276
 - clothianidin 1276–1282
 - dinotefuran 1282–1286
 - nitenpyram 1270–1273
 - vs. ring systems 1286–1288
 - structural segment 1265–1268
 - thiamethoxam
 - six-membered 1309–1311
 - types of 1265–1266
- neriestoxin 1223
- mode of action insects 1241–1244
- neurotransmitter-gated ion channels 1234
- N*-formyl-anilines 750
- 3-[(*N*-heterocyclyl) iminomethyl] pyridines 1502
- N*-hydroxy-anilinopyrimidines 751, 752
- Nicotiana* spp.
- N. plumbaginifolia* 37
 - N. tabacum* 37, 45, 46, 397
- nicotinamide adenine dinucleotide (NADH) 460, 609–614, 623, 703, 727–744, 756, 918, 1156, 1631
- nicotinic acetylcholine receptor (nAChR) 1454
- AChBPs 1233–1234
- competitive modulators
- acetylcholine-binding proteins 1240–1241
 - pharmacophore models 1238–1240
- evolution of 1224
- gene family 1231
- insect 1236–1238

- insect vs. vertebrate 1244–1249
 butenolides 1249
 mesoionic insecticides 1249
 neonicotinoids 1247–1248
 spinosyns 1248
 sulfoximines 1248
 ligand binding sites 1234–1236
 mesoionic insecticide 1389–1393
 mode of action insects
 butenolide 1244
 mesoionic insecticides 1244
 neonicotinoids 1242–1243
 nereistoxin and analogues 1242
 spinosyns 1243–1244
 nereistoxin and analogues 1242
 recombinant hybrid
 insect 1249–1251
 spinosyns MoA 1404–1406
 structure of 1230–1233
 whole cell voltage clamp 1251–1256
 agonists vs.
 antagonists 1254–1256
 electrophysiology vs. radioligand
 binding studies 1252–1254
 nicotinoids 1229, 1234, 1245, 1247,
 1253, 1256
 nikkomycin Z, chitin 1070, 1071
Nilaparvata lugens 1075, 1249, 1272,
 1298, 1323, 1386, 1394, 1464,
 1510, 1555
 nitenpyram 1270–1273
 chemical classification 1270–1271
 physicochemical properties of 1271
 use of 1272
 nitisinone 241–243, 245, 248
 2-nitrobiphenyl 687
 nitroimino-heterocycle 1310–1312,
 1316, 1318
 2-nitroimino-hexahydro-1,3,5-
 triazines 1315
 4-nitroimino-1,3,5-oxadiazinane 1311,
 1315, 1318
N,N-dimethylamino-1,2-dithiolane-4-
 amines 1229
N-(*N,N'*-dimethylaminosulfonyl)
 azoles 664, 666–667
 nonclassical Protocox chemistries
 benzoheterocyclic to
 heterocycle 188–192
 N-phenyl heterocycles 182–186
 phenoxyphenyl and benzyloxyphenyl
 to heterocycle 187–188
 phenyl by benzyl ring
 replacement 192
 phenyl with pyrazole ring
 replacement 192–193
 pyridinecarboxamides 193
 noncompetitive antagonist
 (NCA) 1451–1453, 1455, 1457,
 1458, 1460
 noncompetitive/open-channel blocker
 (NCB) 1242
 noncyclic neonicotinoids
 acetamiprid 1273–1276
 clothianidin 1276–1282
 dinotefuran 1282–1286
 nitenpyram 1270–1273
 vs. ring systems 1286–1288
 nonsteroidal ecdysone agonist 1013,
 1016, 1022, 1026, 1044
 nontarget-site resistance 14, 1001
 enhanced metabolic
 detoxification 21–24
 herbicide distribution 24–25
 norflurazon 213, 217, 218, 223,
 232–234, 237, 243
 norflurazone 234
 novaluron 1073
 noviflumuron 1073
N-phenylpyrazoles 193
N-phenylsulfonylimidazopyridine-2-
 carboxamide lead
 compound 1603, 1604,
 1643–1645, 1647
N-(4-pyridyl/4quinolinyl) aryl
 acetamides 735
N-sulfonyl amino acid amides 856
N-triazolo[1,5-*a*]pyrimidine
 sulfonamides
 biology 114–115, 118–119
 pyroxsulam
 crop selectivity 115–117,
 119–121
 crop utility 115, 119

- N*-triazolo[1,5-*a*]pyrimidine
 sulfonamides (*contd.*)
 ecotoxicology, and
 toxicology 117–118, 121–122
 environmental
 degradation 117–118, 121–122
 synthesis 118
- N*-triazolo[1,5-*c*]pyrimidine
 sulfonanilide
 biology 109
 cloransulam-methyl and diclosulam
 crop selectivity 110
 crop utility 110
 ecotoxicology, and
 toxicology 111–112
 environmental
 degradation 111–112
 florasulam
 crop selectivity 110–111
 crop utility 110
 ecotoxicology, and toxicology 112
 environmental degradation 112
 synthesis 108
 synthetic routes 108
 nucleic acid synthesis 599, 949–956,
 1538
- Nymphalis* spp. 1465
- O**
- Oberon®
 ACCase 1212
 IPM 1218–1219
- ochratoxin A (OTA) 773
- Odontotermes takensis* 1464
- Oebalus* spp. 1465
- oligomycin 625, 1138
- 3-*O*-methyldopamine 857, 858
- Oncopeltus fasciatus* 1050, 1069,
 1071
- oomycete pathogens
 carbendazim and BZ 788
 EC₅₀ values 789
 mutation C239S 787
 and nonoomycete fungi 785
 resistance risk 791–792
- O*-pyrimidinylsalicylic acids 129
- organochlorine-resistant (OCR) 1454
- organophosphates (OPs) 1073, 1146,
 1210, 1229, 1336, 1436, 1440,
 1501, 1549, 1574, 1586,
 1588–1591, 1615, 1636
- organophosphorous (OPs) 1530
- orthosulfamuron 56, 57, 80–81
- orysastrobin 644, 655, 658, 669
- Oryza sativa* 73, 115, 117, 140, 148
- ossamycin 625
- Ostrinia nubilalis* 1031, 1108–1109,
 1119, 1121, 1464, 1573
- Otiiorhynchus sulcatus* 1467
- oudemansin 641
- oudemansin A 587, 634, 638
- oxadiargyl 178
- oxadiazine
 insecticides 1427
 synthesis of 1428
- 1,3,4 oxadiazolon-3-yl ketones 1502
- oxasulfuron 57, 58, 84–85
- oxathiapiprolin
 biological activity, potency and
 effect, on fungal life
 cycle 982–984
 discovery and
 optimization 980–982
 environmental toxicology 986
 mammalian toxicology 985
 physical properties 985
 site of action studies 984–985
- oxidative phosphorylation 1150
 aerobic organisms 610
 ATP synthesis 610
 chemistry 1151–1153
 chlorfenapyr resistance 1154
 diafenthiuron
 biological activity 1144–1146
 structure–activity relationship
 (SAR) 1141–1144
 toxicology and
 ecotoxicology 1144
- dioxapyrrolomycin 1149–1150
- energy conservation
 F₁F₀ATP synthase 624–627
 mitochondrial ADP/ATP
 carrier 627–628
- inhibitors and uncouplers 611

- mitochondrial ATP
 - synthase 1137–1139
 - mitochondrial electron transport chains
 - alternative electron transport chains 623–624
 - complex I and inhibitors 612–614
 - cytochrome *bc1* complex and inhibitors 614, 616–617
 - cytochrome *c* oxidase and inhibitors 617, 620
 - succinate dehydrogenase 620–623
 - mode of action 1139–1141, 1150–1151
 - pest species and markets 1153–1154
 - uncoupler/phosphorylation inhibitor 611
 - UQ binding sites 611
 - oxime ethers 400, 401, 431–432, 641, 642, 645, 654, 660, 861, 1053
 - oximino amides 642–644, 654, 658, 659
 - oximino ester
 - pharmacophore 642
 - strobilurins 642
 - trifloxystrobin 643
 - oximino pharmacophores 668
 - oxpoconazole 811–812
 - oxyacetamide 355, 358–360, 363–371
 - oxycarboxin 681, 682
 - oxysterol binding protein (OSBP) 588, 979, 984, 986
- p**
- paclobutrazol 574, 577, 578, 800
 - Paicer[®] 290
 - Paladin[™] 1588
 - Panonychus* spp. 1089, 1093, 1171, 1177, 1187
 - P. citri* 1188, 1488
 - P. ulmi* 1090, 1188, 1203, 1205
 - paraquat 24
 - Parnellophore* 1461
 - Pasteuria* spp. 1606–1607
 - PDS inhibitors
 - and acute oral toxicity 219
 - enzyme activity 219
 - phenoxybenzamides 219
 - phenoxypyridincarbonamides 219–223
 - phenoxypyridine ethers 223
 - phenylfuranones 223
 - phenylpyridazinones 223–225
 - phenylpyridinones 225–226
 - phenylpyrrolidinones 226
 - phenyltetrahydropyrimidinones 226–227
 - physical data 219
 - structural overlay 227–231
 - structural requirements 231–232
 - pectin methylesterase (PME) 412
 - Pefurazoate 810–812
 - Penconazole 813
 - pencycuron 590, 599, 1299
 - penoxsulam
 - crop selectivity 115–117
 - crop utility 115
 - environmental degradation, ecotoxicology, and toxicology 117–118
 - pentachlorobenzyl alcohol (PCBA) 882
 - pentanochlor 531
 - penthiopyrad 685, 688, 689, 699, 1176
 - pentoxazone 75, 181
 - Periplaneta americana* 1068, 1070, 1244, 1247, 1252, 1284, 1348, 1389, 1390, 1433, 1435, 1457, 1544, 1568
 - Permit[®] 431
 - persistent, bioaccumulative, and toxic substance (PBT) 547, 548
 - persistent organic pollutant (POP) 546
 - Phacelia tanacetifolia* 1346, 1381
 - pharmacophore 639, 641, 643, 645, 647, 655, 669, 1238, 1240, 1241, 1309, 1362, 1365
 - models 1238–1240
 - types 1267
 - phenmedipham 530, 549, 558
 - phenoxan 743
 - phenoxybenzamides 219

- phenoxyphenoxy pyrimidine 126, 187
- phenoxyphenyl and benzyloxyphenyl to heterocycle 187–188
- phenoxy pyridin carbonamides 219–223
- phenoxy pyridine ethers 223, 224
- phenylacetic acid amides 738–740
- phenylamides 589, 596, 599, 865, 871, 955, 956
 - fungicides 954
 - resistance 955
- phenyl carbamates desmedipham 549
- phenyl furanones 223
- phenyl pyrazoles 21, 194, 195, 197, 1449, 1452, 1510
- phenyl pyridazinones 223–225
- phenyl pyridinones 225–226
- 1-phenyl-1-pyrimidinylhydrazines 752
- phenyl pyrimidones 200
- phenyl pyrrole 600, 761–764, 767–776
 - chemistry 768–771
 - foliar and post-harvest usage 771–774
 - mode of action 761
 - Prototox inhibitors 196
 - seed treatment 774–776
- phenyl pyrrolidinones 226, 231
- 2-phenyl-4,5,6,7-tetrahydro-2*H*-indazoles 197
- phenyl tetrahydrophthalimides 177, 179–182, 188
- phenyl tetrahydropyrimidinones 226–227
- phenyluracils 200
- Phorodon humuli* 1216
- phosphinothricin 452, 476, 477, 479–488
- phospholipid biosynthesis 846, 864
- photoaffinity labeling 614, 621, 1256, 1545
- photosynthesis inhibitors
 - approval process, for active substances, in EU 532–538
 - EU regulation
 - MRL regulation 544
- PPP Regulation 545–548
- EU re-registration
 - buffer zone restriction 543
 - dietary intakes, of pesticides residues 540
 - EPPO risk-assessment schemes 542–543
 - fate and behavior of pesticide, in environment 540–541
 - Good laboratory practice (GLP) 538
 - honeybee risk assessment 543
 - nontarget terrestrial arthropods, effects on 544
 - operator exposure data requirements 539
 - physical and chemical characteristics of preparations 539
 - physical and chemical properties, of active substances 538–539
 - residue data requirements 539–540
 - storage stability 539
- Hill reaction 530
- HRAC classification 532
- PS II inhibitors
 - amicarbazone 559–564
 - in EU Markets 548–557
 - market share 558
- photosystem (PS) II inhibitors 15, 365, 394, 529
- phthoxazolin A 415
- p-hydroxyphenylpyruvate (HPP) 24, 241, 242, 245–249
- phytoene desaturase (PDS) 215, 242
 - inhibitors 234–237
 - and ζ -carotene desaturase 217
- phytophagous mites 1085, 1142, 1171, 1172, 1174, 1187, 1482
- Phytophthora infestans* 603, 665, 707, 734, 791, 849, 871, 874, 914, 950, 979
- Phytoseiulus persimilis* 1101, 1518
- picloram 308–311, 315, 318, 321, 324, 336, 346
- picolinafen 222, 233, 234, 238

- picolinic acid 97, 266
 picoxystrobin 643, 656, 657, 659
 piericidin 614, 1156
Pieris rapae 1465
 Pinpoint™ 943
 piperazines 203, 415, 614, 806–812, 980
 piperidines 829–831
 piperidinyl thiazole 979, 980, 986
 piperonyl butoxide (PBO) 1043, 1050, 1140, 1151, 1471
Planococcus citri 1094, 1099, 1100, 1178, 1219, 1275
 plant growth regulators (PGRs) 800
 auxins 573
 chemical structures of 573, 576
 cytokinins 574
 ethylene 573
 gibberellins 573–574
 modern agriculture
 fruiting and growth 577
 fruit storage and ripening 577
 growth inhibitors 574–576
 growth promotion 576
 sprout inhibition 578
 stress defense 578–580
 natural categories 573
 plant nitrogen metabolism 477–479
 plant-parasitic nematodes 993, 1586, 1587, 1593, 1594, 1603–1606, 1615, 1636–1637, 1643–1652
 plant protection products (PPPs) 532, 536, 537, 539, 543–545, 558, 591
 plant regulators (PRs) 326, 571–580
 plastoquinone (PQ) 24, 213, 214, 232, 242
Plodia interpunctella 1114
Plutella xylostella 1030, 1056, 1108, 1114, 1116–1117, 1275, 1362, 1385, 1405, 1437, 1447, 1465, 1531, 1546, 1558, 1563
 polychlorocycloalkane (PCCA) 1451
 polygalacturonase 412
 polyketide synthase (PKS) 588, 882, 883, 1407
 poly-*N*-acetyl-glucosamine 1067
 polyoxin D, chitin 1070, 1071
 ponasterone
 hydrogen bond interactions 1026
 relative positions 1027
Popillia japonica 1038, 1467
 powdery mildew fungicide
 cyflufenamid
 cross resistance and mode of action 934–935
 discovery 933–934
 fungicidal profile 936
 manufacturing process 935–936
 flutianil 943–945
 metrafenone
 cross resistance 938
 formulations and crops 939
 fungicidal profile 938
 manufacturing process 938
 mode of action 938
 registration, products 939
 proquinazid
 discovery 941–942
 fungicidal profile 943
 manufacturing process 942
 registration, products, formulations and crops 942–943
 pyriofenone
 cross resistance and mode of action 940
 manufacturing process 940
 registration, products, formulations and crops 940–941
 prephytoene pyrophosphate (PPPP) 215, 216
 probenazole 604, 905, 959, 963, 964
 profluzol 181, 182
 propanil 531
 propiconazole 812
 propoxycarbazone-sodium 151, 163
 physico-chemical properties 153
 propyrisulfuron 56, 81
 proquinazid
 discovery 941–942
 manufacturing process 942
 prothioconazole 701, 821, 827–829, 925, 1281

- prothoracicotropic hormone
(PTTH) 1055, 1056
- proton-gated chloride channels 1457
- protonophoric uncouplers 704–706,
708–710, 717
- protoporphyrin IX (PPIX) 20, 174,
204
- protoporphyrinogen IX (PPGIX) 20,
174, 187, 188, 194–195, 203,
1202
- protoporphyrinogen-IX-oxidase-
inhibitors (PPO)
inhibitors 1202
- protoporphyrinogen oxidase 20
development
aromatic meta position 199
diphenyl ether 174–176
2,4,5-imidazolidinetriones 197
phenyl pyrrole 195
phenyl ring to
heterocycle 177–179
2-phenyl-4,5,6,7-tetrahydro-2*H*-
indazoles 197
phenyl tetrahydrophthalimides
179–182
protoporphyrinogen IX 194–195
tetrahydrophthalimides 195
tetrasubstituted phenyl
pyrazoles 197
- nonclassical Prottox chemistries
benzoheterocyclic to
heterocycle 188–192
and benzyloxyphenyl to
heterocycle 187–188
N-phenyl heterocycles 182–186
phenoxyphenyl 187–188
phenyl by benzyl ring
replacement 192–193
phenyl with pyrazole ring
replacement 192
pyridinecarboxamides 193
resistant weeds control 203–204
toxicology 204
- Prottox inhibitors
bicyclic heterocyclic ring 200
chemical structures of 175
- Pseudatomoscelis seriatus* 1465
- Pseudaulacaspis*
pentagona 1060–1061
- Psylla pyri* 1211
- pydiflumetofen 689
- pyflubumide
chemical structure 1173
cross-resistance 1177–1178
in vitro selectivity 1179–1180
IRAC classification 1180–1181
lead compound 1174–1175
mode of action 1178–1179
NH-form of 1179–1180
structure–activity relationship
(SAR) 1176–1177
synthesis 1177
synthetic pathway of 1202
toxicity 1178
- pymetrozine 1501
biological activity and use
recommendation of 1510
chemical and physical properties
of 1506, 1509
discovery 1502–1503
insecticidal spectrum of 1510
mode of action 1506–1509
resistance 1509–1510
safety profile 1511
synthesis of 1506, 1508
- pyraclonil 81, 192, 193
- pyraclostrobin 579, 643–645,
655–656, 659, 661, 671
- pyraflufen-ethyl 179
- pyrametostrobin 645
- pyraoxystrobin 635, 645
- pyrazole acetamide 980
- pyrazoline isomers
facile oxidation 1442
new derivatives 1443
synthesis of 1442
- pyrazolines 1424–1428, 1441, 1446
- pyrazolynate (pyrazolate) 288–291,
293, 297
- pyrazoxyfen 241, 244, 290–293
- pyrethroid insecticides, dust
mites 1527
- pyrethroids 991, 1431, 1436, 1501,
1530, 1535, 1554, 1558, 1574

- pyribencarb 639, 644–645, 672, 839
 pyridaben 614, 663, 727, 1164–1165, 1168, 1194, 1209, 1211
 pyridalyl
 beneficial arthropods 1536
 biological aspects
 insecticidal activity and uses 1535–1536
 mode of action 1536–1538
 chemistry
 lead compound, optimization 1532–1534
 lead generation 1532
 commercialising status 1539
 insecticidal activity
 insecticide resistant strain 1535
 lepidopterous pests 1535
 physicochemical properties 1534
 structure 1531
 toxicological profile 1531
 pyridazine
 insecticides 1426
 synthesis of 1428
 pyridine azomethines 1502, 1504, 1506–1507, 1519
 pyridinecarboxamides 193, 194
 pyridinyl-ethyl benzamide
 fluopyram 1630
 agrophoric element 695–696
 biological activity and application rates 698–699
 chemical structure of 694
 cross-resistance pattern 699–701
 fluopyram synthesis 698
 ortho-substituted benzamide residue 696
 physico-chemical properties 695
 structural elements, on biological spectrum 696–697
 pyrifluquinazon
 biological activity and safety profile 1522
 bsafety profile of 1522
 chemical and physical properties of 1521
 discovery of 1518–1519
 mode of action 1521
 resistance 1521–1522
 synthesis of 1520–1521
 pyrimethanil 728, 749, 750, 753, 754, 756
 pyrimidifen 1168, 1175, 1189
 pyrimidines 129, 227, 231, 261, 477, 734, 738, 749, 750, 806–812
 pyrimidinyl carboxy (PC) 140–141
 bispyribac-sodium 136–137
 discovery of 126–128
 mode of action 140–141
 mode of selectivity 141–142
 pyriminobac-methyl 137–140
 pyrithiobac-sodium 134–135
 structure–activity relationship (SAR)
 O-pyrimidinylsalicylic acids 129
 pyrimidinylglycolates 129–133
 pyrimidinylglycolates 126, 128–133
 pyrimidinyl hydrazones 716
 pyrimidinylsalicylates 126, 129, 143
 pyriminobac-methyl 137–140, 142
 pyriminostrobin 664, 1192–1193
 pyrimisulfan, sulfonanilides 147
 pyrimorph 845, 849, 864
 pyriofenone
 formulations and crops 940–941
 manufacturing process 940
 products 940–941
 registration 940–941
 pyriproxyfen
 biological activity
 field evaluations 1057–1061
 laboratory evaluations 1056–1057
 resistance 1061–1062
 formulation 1063
 juvenoid research 1050–1052
 mechanism of action 1053–1056
 optical isomers 1053
 physico-chemical properties 1062
 research process 1052–1053
 stability 1063
 synthesis 1062
 toxicology 1063
 pyrisoxazole 829
 pyrithiobac-sodium 134–135
 pyroquilon 882, 885

- pyrooxasulfone
 biological activities 375–376
 chemistry 374–375
 mode of action 376–380
 physicochemical properties 376
- pyroxsulam
 crop selectivity 119–121
 crop utility 119
 ecotoxicology, and
 toxicology 121–122
 environmental
 degradation 121–122
 soil metabolites of 122
- pyrrolnitrin 767–769
- q**
- quantitative structure–activity
 relationship (QSAR) 187, 530,
 821, 1071, 1096, 1240, 1341, 1409
- quasi-cyclic neonicotinoids 1286
- quinolin-6-yloxyacetamides 785
- quinone outside inhibitor (QoI) 588,
 592, 664, 701, 757, 774, 865, 927,
 934
- quinoxaline 894
- quinoxifen 744
 biology 778–779
 chemistry 776–777
 mode of action 765–766
 synthesis 778
- r**
- regulatory subunits (RSU) 36–37, 141
- RESICORE® 274
- residue definition 545, 547
- resistance management (IRM)
 insect control 1115
 P. xylostella 1116
- resistance management regulatory 998
- resistance-monitoring methods 596,
 998
- resistance mutation 507, 756, 789,
 1453–1454
- respiration inhibitors 611, 628, 634,
 648, 662, 694, 1189
- Reticulitermes flavipes* 1466
- Rhagoletis mendax* 1466
- Rinskor™ 344, 347
- RNA interference (RNAi) 148, 234,
 1077, 1105, 1576
- root-knot nematode (RKN) 1075,
 1488, 1593, 1600, 1603, 1605,
 1615, 1630, 1636, 1644–1645
- rotenone 609, 611, 614, 1156, 1157,
 1163
- Roundup® 455
- roundup hybridization
 system 456–458
- Roundup Ready Plus® (RRP)
 program 467
- Roundup Ready® traits 455, 457
- Roundup Xtend™ 468, 470
- ryanodine receptor (RyRs)
 alkaloid ryanodine 1541
 binding site and target-site
 resistance 1547
 cryo-EM structures 1542
 diamides 1541
 ER/SR stores 1541
 excitation-contraction (e-c)
 coupling 1542
 homotetrameric complexes 1542
 voltage-gated ion
 channels 1542–1543
- Rynaxypyr® 327–328, 1562,
 1564–1565, 1571–1577
- s**
- Saccharomyces cerevisiae* 37, 47, 354,
 614, 761
- Saccharopolyspora spinosa* 1229, 1400
- safeners
 agricultural practice
 cyprosulamide 446–447
 dichloroacetamide 443–444
 fenclorim 444
 fenoxaprop-ethyl 444
 flurazole 443
 fluxofenim 443
 isoxadifen-ethyl 446
 mefenpyr-diethyl 444–446
 1,8-Naphthalic Anhydride
 (NA) 442–443
 cloquintocet-mexyl 432–444

- cyprosulamide 437
 dichloroacetamide safeners
 benoxacor 429–430
 dichlormid 431
 furalazole 431
 gene induction and signaling
 pathways 440–441
 herbicide metabolism, effects
 of 438–440
 herbicide translocation 441–442
 herbicide uptake 441
 isoxadifen-ethyl 436
 mechanism 428, 437–442
 mefenpyr-diethyl 434–435
 oxime ethers 431–432
 Salibro™ 1603–1604, 1646,
 1649–1652
 salicylic acid (SA) 129, 440, 459, 579,
 580, 961, 964, 1300
Salmonella typhimurium 33, 40, 141
 Sanbird® 254, 288, 290
 sangivamycin 416–417
 sarco-/endoplasmic calcium ATPase
 (SERCA) catalyzes 1542
Scapteriscus spp. 1467
 scytalone 588, 889, 893
 scytalone dehydratase (SD) 588,
 882–896
 SDHI carboxamides 1174–1176, 1178,
 1181
 Selectfluor® 927
 selective homopteran feeding
 blockers 993, 1501
 sethoxydim 16, 17, 454, 504, 508, 509,
 934
Sida spinosa 135, 376, 1418
 silthiofam 590, 628
 simeconazole 826–827
 single nucleotide polymorphisms
 (SNPs) 234, 905, 955, 984, 1625
Sitophilus granarius 1415, 1463
 Sivanto® prime 1365
 crop-insect pest spectrum 1374
 foliar vs. drench 1380
 neonicotinoid insecticides 1375
 small brown planthopper
 (SBPH) 1286, 1454
 sodium channel blocker insecticide
 (SCBI) 1437, 1446
 sodium channel blockers 1424
 discovery 1424
 pyrazoline 1424–1425
Sogatella furcifera 1286, 1394, 1454
 soil degradation 87, 111, 185, 275,
 337, 432, 1041, 1396, 1470, 1564,
 1565
 pathways, sulfonylurea 87
 soil fumigant 1587, 1588, 1615
Solenopsis invicta 1466
Sorghum halepense 18, 82, 109, 135,
 400
 spinetoram 1402, 1413
 discovery of 1414
 semi-synthesis 1414
 spinosad
 biological activity 1402–1404
 structures of 1401
 spinosyns 1404–1406
 biosynthesis 1416–1418
 insect vs. vertebrate 1248
 mode of action 1243, 1404–1406
 natural products 1403
 resistance
 and cross-resistance 1406
 semi-synthetic
 modifications 1406–1413
 spinetoram 1413–1416
 spirodiclofen
 cyclic ketoenols 1202–1205
 discovery of 1203
 lipid decrease in 1209
 synthesis of 1206–1207
 spiroketalamines 831–833
 spiromesifen
 cyclic ketoenols 1202–1205
 discovery of 1203
 efficacy of 1210
 synthesis of 1206–1207
 spirotetramat 1216–1218, 1607
 discovery of 1212–1214
 mode of action 1216
 physico-chemical properties 1216
 synthesis of 1214–1215
 transformation of 1217

- Spodoptera* spp. 1488, 1491
S. eridania 1446, 1490
S. exigua 1029, 1074, 1099, 1108, 1413, 1448
S. frugiperda 1218, 1387, 1413, 1416, 1481
S. littoralis 1492, 1494
S. litura 1054, 1532
S. spp. 1531
- squalene epoxidase inhibitors 802, 803, 839
- Standing Committee on Food Chain and Animal Health (SCFAH) 537
- stemofoline 1361–1363
- Stemona* alkaloids 1361, 1362
- Stemonaceae 1361
- Stenchaetothrips* spp. 1464
- sterol biosynthesis inhibitors (SBIs) 589, 591, 753
- in agriculture
 biochemical targets 799–802
 classes of 802–803
 market importance 799
- amines
 biochemical targets 831
 morpholines and piperidines 829–831
 spiroketalamines 831–833
- amino-pyrazolinones 835–836
- DMI fungicides
 piperazines, pyrimidines, and imidazoles 806–809
 triazoles 812–829
 hydroxyanilides 833–835
 squalene epoxidase inhibitors 839
- Streptomyces* spp. 1070, 1485
S. avermitilis 1480, 1482
S. fumanus 1149
S. hygrocopicus 1480
S. hygrocopicus 1485
- strobilurin A 587, 634, 637–639, 648
- strobilurin fungicides
 ametoctradin 667
 azolones 665–666
 biokinetic behavior 649
 Chinese institutes and companies 644–645
 fungal resistance 664
 insecticidal and acaricidal activity 662–664
in vitro testing 634
 lead structures
 commercial potential 641–644
 discovery of 637–641
 metabolic degradation rates 659–660
N-(*N*', *N*'-dimethylaminosulfonyl) azoles 666–667
 patents and developmental/commercial products 636
 plant physiology and crop yield 661–661
 research activities 645–648
 synthesis routes 667
 target activity 648–655
 transportation and distribution 655–659
- strobilurins 798, 871
- structure-activity relationships (SARs) 327, 689, 980, 1488, 1550
 acaricidal carboxamides 1176
 acaricide pyflubumide 1176
 analysis 374
 of anilinopyrimidines 753–754
 bisacylhydrazines 1022–1023
 of 7-chloro-4-phenoxyquinoline 777
 diafenthiuron 1141–1144
 ecdysteroids 1019–1022
 flubendiamide 1553
 flupyradifurone 1368–1369
 isomeric hydrazone 1445
O-pyrimidinylsalicylic acids 129
 phenylpyrrole fungicides 770
 pyrimidinylglycolates 129–133
 pyrimidinylsalicylates 129
 of strobilurins 648–661
 studies 364
 substituent X Y Z 1444
 sulfonanilides
 benzene ring substitution in 145–147
 bridge moiety 144–145
 sulfonamide moiety 144
 sulfoxaflor 1339–1341
 thiamethoxam 1311–1315

- triazolopyrimidine 107
- strychnine-sensitive glycine receptors 1455
- suboesophageal ganglia 1506
- succinate dehydrogenase (SDH) 588, 592, 620–624, 681–691, 694–701, 773, 1630
- biological activity and application 688–689
- carboxylic amides
 - active ingredients 685
 - structure of 681
- metabolism 690
- pyridinyl-ethyl benzamide
 - fluopyram 695
- research activities and patent situation 686
- resistance 690
- structure–activity relationships (SARs) 689
- synthesis 686–688
- sugar beet cyst nematode 1585, 1606
- sulcotrione 241, 243, 244, 258, 269, 270, 273–277, 293, 296
 - soil metabolism 273
 - technical synthesis 270
- sulfentrazone 173, 178, 199, 201, 203
- sulfonamides,
 - triazolopyrimidine 106–107
- sulfonanilides 148
 - discovery of 142–143
 - mode of action 148
 - pyrimisulfan 147–148
 - structure–activity relationship (SAR)
 - benzene ring substitution in 145
 - bridge moiety 144–145
 - sulfonamide moiety 144–147
- sulfonylaminocarbonyl-triazolinones (SACTs)
 - biology
 - cereals grass control 166
 - flucarbazone-sodium 162–166
 - propoxycarbazine-sodium 163
 - TCM 163
 - thiencarbazine-methyl 165
 - inhibitors of 152
 - lead structure
 - discovery of 152
 - optimization of 152–155
 - synthesis
 - sulfonyl component 158–160
 - triazolinone synthesis 161–162
- TCM 155–157
- sulfonylureas (SUs) 39–40
 - acute toxicity of 56–57
 - agricultural utility
 - cereals 61–72
 - crops 84–87
 - maize 82–84
 - rice 73–82
 - development of 58
 - first generation 55, 56
 - introduced before 58–59
 - metabolic fate and behavior,
 - soil 87–88
 - synthesis 58–61
 - weed resistance 49
- sulfosulfuron 56, 65–66
- sulfoxaflor 1347–1349
 - compatibility of 1353
 - discovery 1337
 - environmental toxicology
 - aquatic nontarget species 1347
 - terrestrial nontarget species 1343–1347
 - French tunnel study 1346
 - global field uses 1352–1358
 - global uses 1355
 - mammalian toxicology 1342
 - mode of action 1347
 - physico-chemical, environmental fate
 - properties 1342
 - resistance and cross-resistance 1349
 - spectrum of activity 1351–1352
 - structure–activity relationship (SAR) 1339–1341
 - synthesis of 1337–1339
 - trade names 1352
- sulfoximine 1337
 - HPPD inhibitors 262
 - insect *vs.* vertebrate 1248
 - mode of action 1244
 - progression of 1336
 - synthetic routes 1338

- systemic acquired resistance
(SAR) 579, 603, 685, 717, 959,
961–964, 966–968
- t**
- Talinor™ 278, 433
- Talium® 943
- target-site resistance 14, 1000
- acetolactate synthase (ALS/AHAS)
inhibitors 18–19
 - acetyl-CoA carboxylase (ACCase)
inhibitors 15–18
 - 5-enolpyruvylshikimate-3-phosphate
synthase (EPSPS) 20
 - photosystem II (PS II)
inhibitors 15
 - protoporphyrinogen oxidase
(PPO) 20–21
- tebuconazole 574, 604, 813, 821, 827,
828, 925, 1299
- tebufenozide 1016, 1017, 1022–1025,
1029–1034, 1042, 1043, 1045
- tebufenpyrad 663, 727, 1158, 1163,
1166–1168, 1194, 1195
- tebufloquin
- chemical structure 925–926
 - physicochemical properties 926
 - protective and curative
conditions 927
 - rice disease and rice blast 925
 - synthesis of 926
 - toxicological and environmental
studies 927
- teflubenzuron 1072, 1073
- tefuryltrione 258, 265, 272, 273,
275–277
- tembotrione 24, 164, 165, 244, 245,
254, 258, 265, 272–276, 436, 437
- commercial formulations 277
 - soil degradation 275
 - synthesis of 276
- tentoxin 625, 626
- terbinafine 838, 839
- terrestrial nontarget
species 1343–1347
- tetrachloropicolinic acid 321, 322
- tetraconazole 813–814, 943
- 6-tetrahydro-fur-3-ylmethyl
(TFM) 1282
- tetrahydrophthalimide Protox
inhibitors 177, 195
- tetrahydrophthalimides 174, 179, 180,
182, 183
- tetrahydroquinolines 1044
- 1,3,6,8-tetrahydroxynaphthalene
reductase 880, 882, 885, 898
- 2,2,4,4-tetramethyl-cyclohexane-1,3,5-
trione moiety 259
- 1,1,3,3-tetramethylguanidine
(TMG) 328
- tetramic acid 519, 520, 1005, 1202,
1212, 1214, 1608
- Tetranychus* spp. 121, 1089–1091,
1093, 1171, 1177, 1187, 1209
- T. cinnabarinus* 1145, 1491, 1496
 - T. urticae* 510, 1090, 1092, 1094,
1096, 1099–1101, 1121, 1145,
1149, 1154, 1171–1173, 1178,
1180, 1184, 1185, 1187, 1194,
1202–1205, 1207–1209, 1212,
1218, 1219, 1488–1494, 1496,
1497, 1555
- development stages 1187
- tetrazines 1086–1091, 1093
- tetrodotoxin-resistant (TTX-R) 1435
- tetrodotoxin-sensitive (TTX-S) 1435
- thaxtomins 413–415
- thiacloprid 1300
- activity of 1304
 - chemical classification 1301
 - ovicidal activity of 1304
 - physicochemical properties 1301
 - synthetic pathways 1302
- thiadiazoles 8, 9, 21, 360, 364,
603, 965
- thiamethoxam 1320–1322
- AKD-1022 1316–1317
 - CGA 293'343 1317–1331
 - chemical and physical properties
of 1319–1320
 - discovery 1318
 - ecological toxicology 1328
 - hydrolytic degradation
pathways 1320

- insecticidal relevance
 metabolism 1322
 mode of action 1320–1322
 nitroimino-heterocycles 1316
 physico-chemical properties 1319
 resistance 1323–1325
 safety profile 1325–1327
 six-membered neonicotinoids
 1309
 structure–activity relationship
 (SAR) 1311
 synthesis 1315, 1318–1319
 vigor effect 1327–1331
 thiamine diphosphate (ThDP) 33
 thiatiazines 407–410
 thiazolidinone acaricides 1091, 1093
 thiazolidinone carbamate 397, 410,
 411
 thiazopyr
 biology 494–495
 environmental fate 495
 synthesis of 497–499
 thien carbazole 275, 297, 436, 437
 physico-chemical properties 153
 thien carbazole-methyl (TCM) 152,
 153, 155–158, 163, 165, 166, 293,
 446
 discovery of 155
 sulfonylaminocarbonyl-triazolinones
 (SACTs) 151
 thifluzamide 682, 685–688, 1175
 thioacetamide 686
 thiocarbamate pyributicarb 803
 thiolcarbamate 1052, 1053
 5-thiono-1,2,4-oxazolidinone 1143,
 1144
Thrips spp. 1464
 T. palmi 1058, 1275, 1285, 1405,
 1465, 1535–1536
 T. tabaci 1465, 1517
 tiadinil 604, 605, 685, 959, 960, 964,
 967–968, 971
 tiafenacil 202
 tioazafen 1604
 Collinsville, IL. 1617, 1620
 commercial standards 1616,
 1619–1622
 corn and soy yield 1622
 corn plants 1617
 cotton lint yield 1621, 1622
 crops 1627
 and environmental fate 1623
 formulation 1624–1625
 growing regions 1617
 large scale production 1625–1627
 mode of action 1625
 physical properties 1623
 row crops damage 1616
 SCN sampling 1617
 seed treatment yield 1617
 TIR1/AFB auxin receptors 306–309
 tolfenpyrad 601, 1159, 1163,
 1166–1168, 1195
 tolprocarb
 biological activity 902–904
 inhibiting PKS activity 898
 tolypyralate 298–301
 tomato spotted wilt virus
 (TSWV) 970, 1299, 1465
 topramezone 244, 264, 295–299, 301
Torpedo marmorata 1233–1235
 3D structure 1238
Torpedo nAChR 1233, 1235, 1254,
 1256
 toxicokinetics and metabolic fate
 in animals 1471
 in insects 1471
 transient receptor potential channels
 (TRPV) 1502, 1509, 1517,
 1521
 transmembrane-spanning
 domains 1231
 transmission electron microscopy
 (TEM) 902, 903, 1538
 trehalose 1068
 triadimenol 807, 812, 925
Trialeurodes vaporariorum 1056–1058,
 1145, 1219, 1285, 1298, 1323,
 1356, 1374, 1376, 1510, 1522
 triazines 4, 15, 22, 82, 297, 529, 549
 herbicides 15, 274, 403, 558
 1,3,5-triazines 531
 triazinones 8, 201, 529, 549, 553,
 561

- triazole fungicides 596, 799
 - bromuconazole 819
 - epoxiconazole 816
 - fenbuconazole 814
 - fluquinconazole 824
 - imibenconazole 825
 - ipconazole 822
 - mefentrifluconazole and ipfentrifluconazole 829
 - metconazole 820
 - prothioconazole 827
 - pyrisoxazole 829
 - simeconazole 826
 - tetraconazole 813
 - triticonazole 818
- triazolinone 8, 152, 161–162, 178, 179, 182–184, 201, 363, 368–371, 562, 647
- triazolo[1,5-*a*]pyrimidine
 - sulfonanilides 107, 123
- triazolocarboxamides 9, 12, 401–403
- triazolopyrimidine
 - acetohydroxyacid synthase (AHAS) inhibition 122–123
 - flumetsulam 107
 - N*-triazolo[1,5-*a*]pyrimidine sulfonamides 118–122
 - N*-triazolo[1,5-*c*]pyrimidine sulfonamides 108, 112–118
 - sulfonamides 107
- triazoxide
 - chemical structure 923
 - physicochemical properties 924
 - seed treatment 925
 - synthesis of 923
- tricarboxylic acid cycle (TCA) 1631
- trichloroisocyanuric acid (TCIA) 791
- tricyclazole 605, 882, 885, 899, 1299
- trifloxystrobin 601, 636, 637, 642, 643, 654–657, 659, 663, 668
- trifloxysulfuron-sodium 58, 86–87
- trifludimoxazin 202
- triflumezopyrim 1385
 - biological profile of 1393–1395
 - chemical synthesis 1388–1389
 - comparative activity 1395
 - discovery of 1386–1388
 - insecticidal activity 1394
 - nontarget organisms 1396
 - physicochemical properties of 1388
 - toxicity of 1397
- trifluoroacetic acid (TFA) 328
- trifluoromethylnicotinamides 1511, 1513
 - insecticides 1512
 - structure–activity relationships 1515
- triketones
 - commercialised triketone herbicides
 - benzobicyclon 278
 - mesotrione 274
 - sulcotrione 273
 - tembotrione 276
 - discovery 253
 - mode of action 253–255
 - patent literature
 - BASF triketones 263
 - Bayer CropScience commercialized triketones 265
 - Bayer CropScience triazolypyridine triketones 266
 - Dow triketones 265
 - 6,6 heterocyclic type II bicyclic aroyl systems 267
 - Idemitsu and DuPont triketones 264
 - Ishihara Rice triketones 265
 - Nippon soda types 261
 - Nissan triketones 262
 - ‘One’ HPPD inhibitors 268, 269
 - pyridines and pyrimidines 262
 - Syngenta pyridyl triketones 266
 - Syngenta triazolopyridine triketones 267
 - Zeneca patents 260
 - structure–activity relationships 257–259
 - synthesis of 255–257
- triticonazole 818–819
- Triticum aestivum* 62, 111, 119, 120, 151
- tritosulfuron 56, 57, 69–71

- Tuta absoluta* 997, 1036, 1406, 1437, 1447, 1574
- two-spotted spider mite (TSSM) 1086, 1096, 1099, 1101, 1149, 1184, 1189, 1194, 1202, 1218, 1488–1491, 1493, 1494, 1496, 1497
- Type I polyketide synthase 1417
- Tyrophagus putrescentiae* 1528
- tyrosine 24, 241–243, 245, 454, 620, 690, 700, 789, 879, 893, 894
- u**
- UDP-dependent glycosyltransferases (UGTs) 439
- uncouplers, of oxidative phosphorylation
- arylhydrazones and ferimzone 715–717
- chemical uncouplers 710–714
- diarylamines and fluazinam 717–719
- dinitrophenols and meptyldinocap 715
- mechanism
- ATP synthesis 703
- bimolecular 705
- cell death 703
- ionophores 704
- membrane permeability transition (MPT) 704
- monomolecular 705
- protonophoric uncouplers 704
- physicochemical properties 708–710
- resistance 707–708
- selectivity and toxicity 706–707
- uncoupler usnic acid 706
- uracil heterocycles 184–185, 192, 198
- urban pest control
- applications 1466–1467
- ureas 266, 411, 529, 549, 1071–1074, 1440, 1535, 1558
- U.S. Environmental Protection Agency (EPA) 203, 428, 771, 927, 998, 1038, 1063, 1109, 1153, 1249, 1342, 1381, 1429, 1446, 1587
- v**
- validamycin 590, 606, 1273, 1280
- valifenalate 845, 853–855
- valinomycin 704
- VaporGrip® 468–470
- vegetative insecticidal proteins (Vips) 1104
- Velum Total™ 1603
- venturicidin A 625
- Verango™ 1586, 1602–1603, 1642
- vermelone 889, 893
- vertebrate
- n*AChR subunits 1231–1232
- subunits 1231, 1456
- vertebrate γ -aminobutyric acid 1480
- very long-chain fatty acid elongase (VLCFAE) 377
- very long chain fatty acids (VLCFAs)
- definition and role of 351
- fatty acid elongation
- basics of 352–353
- FAE-like condensing enzymes 353
- phylogenetic analyses 353
- substrate specificity
- determination 353–354
- HRAC classification and characteristics 359
- mode of action
- cell division inhibition 355
- modeling 358–359
- primary targets, history of 354–355
- target enzyme 355–357
- target protein 357–358
- resistance 359–360
- Vespula germanica* 1467
- Vivando® 939
- voltage-gated calcium channels (CaV) 1243, 1568
- voltage-gated sodium channels (vgSCs) and dihydropyrazoles 1433–1435
- insect 1431–1432
- mammalian 1435–1436
- neurotoxin/insecticide 1433

- voltage-gated sodium channels (vgSCs)
(*contd.*)
 proinsecticide action of
 indoxacarb 1432–1433
 stages 1432
Votivo™ 1282, 1586, 1605–1606
- W**
- water-dispersible (WG) 68–70, 76,
1279, 1302, 1414, 1557
Weed resistance 4, 13, 27, 28, 203,
204, 234, 309, 456, 459, 464, 466,
469, 473, 497
white-backed planthopper
(WBPH) 1286, 1394, 1454
Widestrike 1111, 1112
wild type (WT) 461, 462, 1350, 1351
Working Group on Pesticides
(WGP) 533
World Health Organization (WHO) 532,
914, 996, 1299, 1404
- X**
- Xenopus*
 X. laevis 1236, 1405, 1435
 X. oocytes 1249, 1322, 1390, 1453,
1454
- X-ray crystallography 248, 504, 613,
614, 617, 624, 627, 628, 906,
1233, 1237, 1542, 1633
- Y**
- Yakawide® 293
- Z**
- Zea mays* 40, 82, 245, 411
ζ-carotene desaturase 215, 217, 218
zonal Rapporteur Member State
(ZRMS) 536
zoxamide
 biology and use in
 agriculture 793
 competitive binding
 assays 786–787
 mechanism of action 785–786
 metabolism and
 toxicology 792–793
 primary markets 785
 resistance risk 791–792
 structure–activity
 relationships 789–791
 synthesis 791
 target-site-based resistance,
787–789