

Table SI-1. List of compounds analyzed for composite be samples, separated by instrumentation used for analysis (gas chromatography-tandem mass spectrometry and liquid chromatography-tandem mass spectrometry)

GC-MS/MS

3,5-Dichloroaniline	Fenbuconazole
Acibenzolar-methyl	Fenpropathrin
Alachlor	Fenpyroximate
Allethrin	Fenthion
Atrazine	Fipronil
Azinphos Methyl	Fipronil Desulfinyl
Azoxystrobin	Fipronil Desulfinyl Amide
Benfluralin	Fipronil Sulfide
Bifenthrin	Fipronil Sulfone
Boscalid	Fluazinam
Bromuconazole	Fludioxinil
Butralin	Flufenacet
Butylate	Flumethralin
Captan	Fluopicolide
Carbaryl	Fluoxastrobin
Carbofuran	Flusilazole
Chlorothalonil	Flutolanil
Chlorpyrifos	Flutriafol
Chlorpyrifos oxon	tau-Fluvalinate
Clomazone	Fluxapyroxad
Coumaphos	Hexazinone
Cycloate	Imazalil
Cyfluthrin	Indoxacarb
Cyhalofop-butyl	Iprodione
Cyhalothrin	Kresoxim-methyl
Cypermethrin	Malathion
Cyproconazole	Malathion oxon
Cyprodinil	Metaxyl
DCPA (Dacthal)	Metconazole
Deltamethrin	Methidathion
Diazinon	Methoprene
Diazinon oxon	Methyl Parathion
Difenconazole	Metolachlor
Dimethomorph	Molinate
Dithiopyr	Myclobutanil
EPTC (Eptam)	Napropamide
Esfenvalerate	Novaluron
Ethalfuralin	Oxydiazon
Etofenprox	Oxyfluorfen
Famoxadone	p,p'-DDD
Fenamidone	p,p'-DDE
Fenarimol	p,p'-DDT

LC-MS/MS

3,4-Dichloroaniline
Acetamiprid
Clothianidin
DCPMU [3-(3,4-dichlorophenyl)-1-methylurea]]
DCPU (3,4-dichlorophenylurea)
Dinotefuran
Diuron
Imidacloprid
Thiacloprid
Thiamethoxam

Appendix A. Supplementary data

Exposure of native bees foraging in an agricultural landscape to current-use pesticides

Michelle L. Hladik^a, Mark Vandever^b and Kelly L. Smalling^c

^aU.S. Geological Survey, California Water Science Center, 6000 J Street, Placer Hall,
Sacramento CA 95819, USA, mhladik@usgs.gov

^bU.S. Geological Survey, Fort Collins Science Center, 2150 Centre Ave Bldg C, Fort Collins CO
80526 USA, vandeverm@usgs.gov

^cU.S. Geological Survey, New Jersey Water Science Center, 3450 Princeton Pike, Suite 110
Lawrenceville NJ 08648 USA, ksmall@usgs.gov

Table SI-2. List of gas chromatography-tandem mass spectrometry (GC-MS/MS) multiple reaction monitoring (MRM) transitions.

Compound	Quant MRM	CE	Qual 1 MRM	CE	Qual 2 MRM	CE
3,5-dichloroaniline	161>99	25	161>90	25	163>90	25
Acibenzolar-methyl	135>63	25	135>107	10	153>77	20
Alachlor	160>130	25	181>131	25	146>117	20
Allethrin	123>81	6	136>93	10	136>77	22
Atrazine	215>58	10	200>104	20	200>94	20
Azinphos-methyl	160>77	20	132>77	15	132>51	30
Azoxystrobin	344>329	15	344>183	30	344>172	40
Benfluralin (Benefin)	292>160	20	292>159	25	292>188	15
Bifenthrin	181>165	22	181>115	35	165>139	28
Boscalid	140>112	10	140>76	20	112>76	15
Bromuconazole	173>145	20	173>109	30	175>147	20
Butralin	266>220	10	266>174	25	224>132	20
Butylate	146>90	5	156>57	5	146>57	10
Captan	79>77	15	117>82	35	149>70	15
Carbaryl	144>115	25	115>65	20	144>89	30
Carbofuran	164>149	10	149>103	15	164>103	25
Chlorothalonil	264>168	30	266>231	20	264>203	20
Chlorpyrifos	197>169	15	314>258	15	258>166	25
Chlorpyrifos oxon	197>169	10	270>190	15	242>206	20
Clomazone	125>89	20	125>99	20	204>107	20
Coumaphos	210>182	10	362>109	15	226>163	20
Cycloate	83>55	5	154>83	5	215>83	15
Cyfluthrin	163>127	6	199>170	22	163>91	8
Cyhalofop-butyl	256>120	10	256>91	30	229>109	15
Cyhalothrin	181>152	22	197>91	22	197>161	6
Cypermethrin	181>152	18	163>91	8	163>127	6
Cyproconazole	139>111	15	139>75	30	222>125	25
Cyprodinil	224>208	25	224>197	25	210>92	20
DCPA	299>221	25	332>301	10	299>271	15
Deltamethrin	253>93	16	253>91	24	208>181	8
Diazinon	199>93	15	152>84	20	179>137	15
Diazinon oxon	137>84	15	273>217	15		
Difenoconazole	323>265	20	267>204	20	267>185	30
Dimethomorph	301>165	15	301>139	15	301>258	15
Dithiopyr	354>286	15	286>210	15	306>210	25
EPTC	132>62	15	189>100	15	160>58	15
Esfenvalerate	125>89	12	225>119	18		
Ethalfuralin	276>202	15	276>105	30	276>231	15
Etofenprox	163>107	16	163>135	5	163>77	30
Famoxadone	197>141	10	224>167	20	330>210	20
Fenamidone	125>89	20	125>99	20	125>63	30
Fenarimol	139>111	15	139>75	30	219>107	15
Fenbuconazole	129>102	20	129>78	20	198>129	10
Fenhexamid	97>55	10	177>113	20	117>78	20
Fenpropathrin	181>152	25	208>181	5	141>115	15
Fenpyroximate	213>77	30	213>142	20		
Fenthion	278>109	20	169>153	20	278>125	20
Fipronil	367>213	30	213>178	15	213>143	25
Fipronil desulfinyl	388>333	15	390>335	15	388>281	30
Fipronil desulfinyl amide	406>390	30	390>307	25	406>351	15
Fipronil sulfide	351>255	15	255>228	15	420>351	10
Fipronil sulfone	383>255	20	383>213	30	452>383	10
Fluazinam	418>372	20	372>337	25	180>160	15
Fludioxinil	248>182	14	248>154	20	127>74	25
Flufenacet	151>136	10	123>95	20	211>69	25

Flumetralin	143>107	20	145>83	20	157>109	25
Fluopicolide	209>182	20	173>109	5	347>172	30
Fluoxastrobin	201>170	15	201>142	25	201>115	30
Flusilazole	233>165	25	233>109	30	206>151	15
Flutolanil	173>145	15	145>95	15	281>173	15
Flutriafol	123>95	15	219>123	15	219>95	30
Fluxapyroxad	159>139	15	159>57	25	159>83	20
Hexazinone	171>71	10	171>85	10	128>83	10
Imazalil	215>173	5	175>147	20	175>109	30
Indoxacarb	150>123	20	203>134	10	134>78	15
Iprodione	187>124	25	244>187	10	187>159	15
Kresoxim-methyl	116>89	15	131-89	30	131-116	20
Malathion	173>99	10	125>79	10	173>117	10
Malathion oxon	127>99	5	142>79	15	127>71	15
Metalaxyl	132>117	16	160>130	20	206>132	20
Metconazole	103>77	15	268>180	20	206>118	20
Methidathion	145>85	5	145>58	15	125>79	10
Methoprene	111>55	15	107>91	15	111>83	15
Methyl parathion	263>109	10	125>79	10	109>79	10
Metolachlor	240>162	10	211>162	10	163>134	15
Molinate	126>55	10	126>98	5	187>55	25
Myclobutanil	179>125	15	179>90	35	150>123	20
Napropamide	128>72	5	115>89	15	128>100	5
Novaluron	157>141	5	141>113	15	141>63	30
Oxydiazon	175>112	15	258>175	5	175>76	30
Oxyflurofen	252>196	25	300>223	20	252>170	25
p,p'-DDD	235>165	20	235>199	15	199>164	20
p,p'-DDE	246>176	25	318>246	10	318>283	10
p,p'-DDT	235>165	15	235>199	15	176>150	15
Paclobutrazol	125>89	20	236>125	20	138>103	15
Pebulate	128>57	5	161>128	5	203>57	15
Pendimethalin	252>162	10	252>192	10	192>146	15
Pentachloroanisole	265>237	10	237>119	20	239>143	20
Pentachloronitrobenzene	214>179	15	214>144	30	237>143	25
Permethrin	163>91	8	183>168	8	183>77	18
Phenothrin	123>81	6	183>77	22	123>77	28
Phosmet	160>77	20	160>133	15		
Picoxystrobin	145>102	30	145>91	20	173>115	20
Piperonyl butoxide	149>91	15	193>145	10	193>107	10
Prodiamine	321>216	15	275>209	25	279>186	15
Prometon	225>168	10	225>58	15	210>112	15
Prometryn	241>184	10	226>69	25	184>102	15
Propanil	219>163	5	163>99	25	163>126	15
Propargite	135>107	15	201>88	10	173>115	15
Propiconazole	173>145	15	173>109	30	259>69	15
Propyzamide	173>145	15	145>109	15	254>191	15
Pyraclostrobin	132>77	20	132>104	10	164>132	15
Pyridaben	147>117	20	147>132	15	132>117	15
Pyrimethanil	198>118	30	198>158	20	118>91	10
Quinoxifen	237>208	30	133>98	15	307>237	20
Resmethrin	123>81	5	171>128	14	123>95	6
Simazine	173>138	5	186>68	25	201>172	10
Tau-Fluvalinate	250>55	12	250>200	18		
Tebuconazole	125>89	20	125>99	20	2520>125	20
Tebupirimfos	261>137	15	318>152	10	261>153	15
Tebupirimfos oxygen analog	218>110	20	245>137	25	245>199	20
Tefluthrin	177>127	14	197>141	8		
Tetraconazole	101>51	10	171>136	10	159>89	30

Tetradifon	159>131	10	229>201	15	159>111	20
Tetramethrin	164>77	22	123>77	20		
Thiazopyr	327>277	30	306>230	15	363>300	15
Thiobencarb	100>72	5	125>89	15	257>100	10
Triadimefon	111>75	15	128>65	25	181>91	10
Triadimenol	119>91	10	119>65	30	293>91	30
Triallate	143>83	15	268>184	20	270>186	15
Tribufos	169>95	5	169>57	5	202>113	15
Trifloxystrobin	116>89	15	116>63	30	131>116	20
Triflumizole	206>186	20	206>179	20	179>144	15
Trifluralin	264>160	15	306>160	25	290>202	20
Triticonazole	371>293	20	293>91	30	293>119	10
Vinclozolin	187>124	20	198>145	15	198>109	30
Zoxamide	187>159	15	187>123	30	159>89	30
¹³ C ₁₂ - <i>p,p'</i> -DDE (surrogate)	258>188	30	330>260	20	258>223	20
¹³ C ₆ - <i>cis</i> permethrin (surrogate)	189>171	10	189>159	10	190>160	10
d ₁₀ -trifluralin (surrogate)	315>50	15	267>163	15	315>209	15
d ₁₀ -acenaphthene (internal standard)	164>160	30	160>156	30	160>80	35

Table SI-3. Time points when enough bees were collected to analyze for pesticides; traps were set out at all dates but did not always capture enough bees.

Field	Year	Late May/ Early June	Mid June	Early July	Mid July	Early August	Mid- August	Early September	Late September/ Early	Total Samples
Grass-1	2013				x	x	x	x	x	5
	2014	x				x	x	x	x	5
Grass-2	2013		x	x	x	x	x	x	x	7
	2014	x					x			2
Grass-3	2013		x			x	x	x	x	5
	2014						x	x	x	3
Grass-4	2013		x				x	x	x	4
	2014	x			x		x			3
Wheat-0	2014				x	x	x	x		4
Wheat-1	2014				x		x	x		3
Wheat-2	2014				x	x	x	x		4
Wheat-3	2014						x	x		2
Wheat-4	2014					x	x	x		3
Wheat 5	2014					x	x	x	x	4
Total Samples Per Date		3	3	1	6	8	14	12	7	54

Table SI-4. Concentrations (in ng/g) of pesticides detected in composite bee samples. Nd = not detected; NA = not available.

Site	Date	# of bees	Mass (g)	Herbicides			Neonicotinoid Insecticides			Non-neonic Insecticides					Fungicides							
				Atrazine	Metolachlor	Hexazinone	Clothianidin	Imidacloprid	Thiamethoxam	Bifenthrin	Permethrin	Chlorpyrifos	Fipronil	Fipronil Desulfinyl	Azoxystrobin	Difenconazole	Fenbuconazole	Fluxapyroxad	Propiconazole	Pyraclostrobin	Tebuconazole	Trifloxystrobin
Honey Bee	LD50 contact	ng/bee		>97,000	>110,000	>100,000	22 to 44	18 to 240	24 to 29	15	23 to 130	10 to 114	3.9 to 12	NA	> 200,000	NA	>292,000	>370,000	>25,000	>100,000	NA	>200,000
Grass-1	7/19/2013	6	0.223	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/3/2013	15	0.960	nd	nd	nd	nd	nd	nd	8.8	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/15/2013	14	1.342	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	9/4/2013	5	0.476	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	9/27/2013	13	0.783	99	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	5/23/2014	8	0.590	23	nd	nd	8.6	1.1	230	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/1/2014	10	0.710	nd	nd	nd	20	nd	34	4.3	nd	nd	nd	nd	nd	6.6	nd	nd	3.0	nd	nd	nd
	8/15/2014	10	0.703	6.9	13	nd	nd	nd	nd	12	nd	19	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	9/5/2014	9	0.839	nd	nd	nd	57	nd	56	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	10/3/2014	10	0.399	nd	nd	nd	nd	nd	25	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Grass-2	6/20/2013	11	0.229	nd	nd	nd	7.3	21	21	nd	nd	nd	nd	nd	nd	nd	nd	9.3	nd	nd	nd	nd
	7/3/2013	6	0.083	nd	nd	nd	nd	nd	16	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	7/19/2013	15	0.866	nd	nd	nd	nd	nd	6.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/3/2013	8	1.055	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/15/2013	10	0.936	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	9/4/2013	10	1.087	nd	nd	nd	52	69	56	nd	nd	nd	nd	1.1	25	25	nd	10	nd	42	nd	14
	9/27/2013	10	0.408	nd	nd	nd	60	82	56	nd	nd	nd	nd	nd	nd	nd	nd	2.2	nd	nd	nd	nd
	6/6/2014	10	0.809	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/15/2014	10	0.922	4.2	13	nd	5.7	nd	41	nd	nd	55	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	6/20/2013	13	0.383	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Grass-3	8/3/2013	5	0.477	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/15/2013	10	0.830	nd	nd	nd	nd	nd	nd	nd	nd	nd	3.1	2.1	nd	nd	nd	nd	3.1	nd	3.9	nd
	9/4/2013	10	0.531	nd	nd	nd	nd	nd	nd	15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	9/27/2013	15	0.750	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/15/2014	6	0.522	14	nd	27	nd	nd	nd	18	nd	30	nd	nd	nd	nd	1.5	nd	nd	37	nd	nd
	9/5/2014	10	0.750	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	10/3/2014	10	0.249	nd	nd	nd	15	nd	310	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	6/20/2013	4	0.181	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/15/2013	6	0.364	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	3.2	nd	nd	nd	nd	nd	nd	nd	nd
	9/4/2013	10	0.933	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Grass-4	9/27/2013	12	0.313	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	4.9	nd	nd	nd	nd	nd	nd	nd	nd
	5/23/2014	10	1.889	nd	nd	nd	nd	nd	21	nd	nd	nd	nd	nd	0.7	nd	nd	nd	nd	nd	nd	nd
	7/18/2014	8	0.578	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/15/2014	10	0.740	7.3	nd	nd	nd	nd	nd	12	nd	16	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	7/18/2014	10	0.773	nd	nd	nd	nd	nd	12	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/1/2014	10	0.795	nd	nd	nd	5.5	3.8	8.5	12	nd	nd	nd	nd	5.8	nd	nd	nd	nd	nd	nd	nd
	8/15/2014	10	0.900	8.3	11	nd	nd	nd	13	11	nd	26	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	9/5/2014	10	0.649	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	7/18/2014	8	0.824	nd	nd	nd	nd	14	36	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/15/2014	10	1.003	4.0	10	nd	nd	nd	8.7	9.9	nd	21	nd	nd	nd	nd	nd	nd	81	nd	nd	nd
Wheat-1	9/5/2014	10	0.709	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	2.1	nd	nd	nd	nd	nd	nd	nd
	7/18/2014	10	0.425	nd	nd	nd	nd	nd	71	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/1/2014	9	0.401	nd	nd	nd	87	nd	120	nd	nd	nd	nd	nd	9.1	nd	nd	nd	7.0	nd	nd	nd
Wheat-2	8/15/2014	10	0.643	11	13	nd	nd	nd	4.8	6.4	nd	21	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	9/5/2014	10	0.877	nd	nd	nd	nd	6.3	nd	nd	nd	nd	nd	nd	nd	nd	nd	1.6	nd	nd	nd	nd
	8/15/2014	10	0.685	nd	nd	nd	nd	nd	nd	7.6	120	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Wheat-3	9/5/2014	10	0.566	nd	nd	nd	2.6	nd	3.2	nd	nd	nd	nd	nd	nd	nd	nd	2.6	nd	nd	nd	nd
	8/1/2014	6	0.400	nd	nd	nd	15	nd	14	3.8	nd	nd	nd	nd	4.3	nd	nd	6.4	54	nd	nd	nd
	8/15/2014	10	1.412	2.5	nd	nd	nd	nd	1.3	4.1	nd	4.9	nd	nd	nd	nd	nd	nd	7.6	nd	nd	nd
Wheat-4	9/5/2014	8	0.613	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	8/1/2014	8	0.607	nd	nd	nd	15	1.3	18	6.0	nd	nd	nd	nd	2.9	nd	nd	2.5	nd	nd	nd	nd
	8/15/2014	10	0.538	nd	nd	nd	nd	nd	nd	19	nd	14	nd	nd	nd	nd	nd	nd	11	nd	nd	nd
	9/5/2014	10	0.539	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Wheat-5	10/3/2014	8	0.234	nd	nd	nd	nd	nd	26	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table SI-5. Percent of different land cover for each field at the 1000 m buffer radius; land cover data take from USDA CropScape-Cropland Data Layer, <http://nassgeodata.gmu.edu/CropScape/>

Field	Year	Developed/ Open Space	Grassland/ Pasture	Fallow/Idle Cropland	Winter Wheat	Corn	Other Crops (Millet/Sunflower/Sorghum)
Grass-1	2013	0.03	0.39	0.04	0.40	0.15	0.00
	2014	0.03	0.39	0.07	0.01	0.19	0.32
Grass-2	2013	0.05	0.68	0.08	0.12	0.06	0.00
	2014	0.05	0.65	0.12	0.10	0.04	0.04
Grass-3	2013	0.03	0.20	0.14	0.35	0.00	0.28
	2014	0.03	0.19	0.52	0.14	0.00	0.11
Grass-4	2013	0.02	0.92	0.04	0.00	0.00	0.02
	2014	0.02	0.89	0.00	0.03	0.00	0.05
Wheat-0	2014	0.02	0.13	0.29	0.55	0.00	0.01
Wheat-1	2014	0.01	0.15	0.37	0.14	0.15	0.18
Wheat-2	2014	0.03	0.21	0.19	0.43	0.09	0.05
Wheat-3	2014	0.03	0.34	0.15	0.27	0.03	0.18
Wheat-4	2014	0.03	0.01	0.25	0.55	0.00	0.16
Wheat 5	2014	0.03	0.01	0.33	0.53	0.00	0.10