S2 Appendix. Representative lowest observed effect concentrations (LOEC) for neonicotinoid sublethal toxicity in honey bees.

Neonicotnoid (a.i.)	Test Doses	Mode of Exposure	Time of exposure	LOEC	Endpoint	Study Type	Reference
Acetamiprid	0, 0.1, 0.5, 1.0 µg/bee	Oral	Acute	≤100 ng/bee	Impaired long-term retention of olfactory learning	Laboratory	[1, 2]
Acetamiprid	0, 0.1, 1.0 µg/bee	Oral	Acute 24 hrs	≤100 ng/bee	Increase in responsiveness to water	Laboratory	[2]
Acetamiprid	0, 0.1, 0.5, 1.0 µg/bee	Topical	Acute	≤100 ng/bee	Increased locomotor activity and water-induced proboscis extension reflex	Laboratory	[1]
Clothianidin	0, 0.1, 0.5, 1.0, 2.0 ng/bee	Oral	Acute 30-90 min	0.5 ng/bee	Significant change in locomotor activity	Laboratory	[3]
Clothianidin	0, 0.06, 0.3, 0.6, 0.9, 3.0, 6.0, and 12.0 ng/bee	Oral	Acute	0.9 ng/bee	Changes specificity of the early long-term memory (24 h)	Laboratory	[3]
Clothianidin	0, 0.03, 0.06, 0.12, 0.24 ng/bee	Oral	Chronic up to 4 weeks	0.12 ng/bee	Increased AChE activity with associated hyperactivity and decreased survival	Laboratory and Field	[4]
Clothianidin	0, 0.05, 0.5, 1.0, 2.0 ng/bee	Oral	Acute, single dose	0.5 ng/bee	Increase the time spent at feeder, flight time to feeder or to hive, time in hive between trips and trip duration	Field	[5]
Clothianidin	0, 2.5 ng/bee	Oral	Acute	≤2.5 ng/bee	Modifications in the length and directional components of vector flight and homing flight	Field	[6]
Clothianidin	0.545-10.9 ng/bee	Topical	Acute 30 minutes	2.18 ng/bee	Reduction in successful homing flight	Field	[7]

Neonicotnoid (a.i.)	Test Doses	Mode of Exposure	Time of exposure	LOEC	Endpoint	Study Type	Reference
Dinotefuran	0, 1.9-37.5 ng/bee	Topical	Acute 30 minutes	7.5 ng/bee	Reduction in successful homing flight	Field	[7]
Imidacloprid	0, 10, 100, 1000 µM	Oral	Subchronic 6 days	1.3 ng/bee	Impairment of various aspects of olfactory learning and memory formation	Laboratory	[8]
Imidacloprid	0, 2, 10 ng/bee	Oral	Acute, a few hours	≤2 ng/bee	Reduction in mobility (moving time ratio and the speed of movements)	Laboratory	[9]
Imidacloprid	0, 0.1, 1.0 ng/bee	Oral	NR	≤0.1 ng/bee	Impairment of olfactory learning	Laboratory	[10]
Imidacloprid	0, 0.1, 1.0 ng/bee	Oral	Acute 4 hrs	≤0.1 ng/bee	Changed in the number of trials to habituation in an age-dependent manner	Laboratory	[11]
Imidacloprid	0, 0.01, 0.1, and 1.0 ng/bee	Oral	Subchronic 8-10 days	0.1 ng/bee	Increased mortality of workers	Laboratory	[12]
Imidacloprid	~0.8-81 ng/bee	Oral	Chronic	~≤1 ng/bee	Altered foraging behavior	Laboratory	[13]
Imidacloprid	0, 0.21, 2.16 ng/bee	Oral	Acute 1 - 24 hrs	≤ 0.21 ng/bee	Higher sucrose response thresholds (1 hr) and a reduction in waggle dance circuits (24 hrs)	Laboratory	[14]
Imidacloprid	0, 0.453 ng/bee	Oral	Acute 24 hrs	≤0.453 ng/bee	Disruption of the righting reflex and increased grooming	Laboratory	[15]
Imidacloprid	0, 0.08, 0.16, 0.24, 0.30 ng/bee	Oral	Chronic up to 4 weeks	≤0.08 ng/bee	Increased AChE activity with associated hyperactivity and decreased survival	Laboratory and Field	[4]
Imidacloprid	0, 0.15, 1.5, 3.0, 6.0 ng/bee	Oral	Acute, single dose	1.5 ng/bee	Increase the time spent at feeder, flight time to feeder or to hive, time in hive between trips and trip duration	Field	[5]

Neonicotnoid (a.i.)	Test Doses	Mode of Exposure	Time of exposure	LOEC	Endpoint	Study Type	Reference
Imidacloprid	0, 7.5, 11.25 ng/bee	Oral	Acute	≤7.5 ng/bee	Modifications in the length and directional components of vector flight and homing flight	Field	[6]
Imidacloprid	0, 1.25, 2.5, 5, 10, and 20 ng/bee	Topical	Acute	≤1.25 µg/bee	increases the motor activity and facilitates the PER habituation independently of time.	Laboratory	[16]
Thiacloprid	0, 1.25 µg/bee	Oral	Acute	≤1.25 µg/bee	Modifications in the length and directional components of vector flight and homing flight	Field	[6]
Thiamethoxam	0, 1.3 ng/bee	Oral	NR	≤1.3 ng/bee	Locomotor deficit	Laboratory	[17]
Thiamethoxam	0, 0.428, 4.28 ng/bee	Oral	Subchronic 8 days	≤0.428 ng/bee	Condensed cells in mushroom bodies and optical lobes, cytoplasm vacuolization, increased apocrine secretion, increased cell elimination	Laboratory	[18]
Thiamethoxam	0, 1.34 ng/bee	Oral	Acute	≤1.34 ng/bee	Reduction in successful homing flight and increased mortality for foragers	Field	[19]
Thiamethoxam	0, 1.95, 2.90, 3.71, and 4.53 ng/bee	Oral	Acute (1-48 hrs)	≤1.96 ng/bee	Decreased flight duration, distance, and average velocity	Field	[20]
Thiamethoxam	0, 3.8 ng/bee	Topical	NR	≤3.8 ng/bee	Locomotor deficit	Laboratory	[17]
Thiamethoxam	0, 0.1, 1.0 ng/bee	Topical	Acute 24 hrs	≤0.1 ng/bee	Significant decrease of olfactory memory	Laboratory	[2]
Thiamethoxam	0, 2.56, 5.12, 51.2 ng/bee	Topical	Acute 48 hours	≤2.56 ng/bee	Changes in biochemical markers for toxicity	Laboratory	[21]

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