

NEONICOTINOID SUSCEPTIBILITY IN HOUSE FLY, GERMAN COCKROACH, AND RAT FLEA

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Abstract Imidacloprid, acetamiprid, thiamethoxam and thiacloprid have the same mode of action. They are agonists the nicotinic acetylcholine receptor, affecting the synapses in the insect central nervous system. These insecticides are gaining widespread use for controlling urban insect pests in Russia. Four neonicotinoid insecticides — imidacloprid, acetamiprid, thiamethoxam (95-97%; technical grade) and thiacloprid (48% suspension concentrate) — were evaluated under laboratory conditions against the standard susceptible laboratory strain of the German cockroach, *Blattella germanica* (L.), the house fly, *Musca domestica* L. and rat flea, *Xenopsylla cheopis* Roth.

In our experiments we used three techniques: 1) the topical application test — direct treatment of individuals; 2) the oral test — treatment of the insect food (dry sugar baits and water syrup for flies and dog's biscuits plus egg yolk for cockroaches); 3) 60-min. contact with impregnated paper method for rat flea, 15-60-min. contact with glass method for cockroach and fly. Topical application - for house flies LD₅₀ of imidacloprid were 350.0, thiacloprid 303.0, acetamiprid 28.0 and thiamethoxam 13.3 µg/g; for cockroaches — 5.6, 7.3, 5.4 and 0.24 µg/g, respectively. Thiamethoxam was most active neonicotinoid for both species.

Insects have high ability for recovery after treatment with neonicotinoids. For cockroaches maximum recovery coefficient (6 HAT to 48 HAT) was registered for thiacloprid (18.0), lesser for acetamiprid (5.0) and imidacloprid (4.6), and minimum for thiamethoxam (1.0).

Neonicotinoids have low toxicity for cockroach and house flies when they have contact with glass LC₅₀ >10 mg/dm² for imidacloprid, acetamiprid and thiacloprid. Thiamethoxam was more active - LC₅₀ 0.4 mg/dm² for cockroaches and 0.08 mg/dm² for house flies. Imidacloprid and acetamiprid were more toxic to rat flea - LC₅₀ were 5.4 and 1.7 mg/dm², respectively. Thiamethoxam was less toxic - >100.0 mg/dm². Intestinal activities were - LC₅₀ for house flies (both dry and syrup bait) imidacloprid 0,065, thiacloprid 0,060, acetamiprid 0.050 and thiamethoxam 0.017 µg/fly; for cockroaches (dry baits) — 6.0, 9.5, 2.8 and 2.5 mg/g bait, respectively. Baits containing insecticide were more toxicity for flies, than cockroaches 12.6, 26.6 and 42.5 times for imidacloprid, acetamiprid and thiamethoxam, respectively. There was no repellency for house flies.

We investigate the aversion of these baits in cockroaches and conclude, that imidacloprid is preferable, and thiamethoxam cause the most aversion effect. Repellent effect was very strong to cockroaches in the special experiments when they had to cross over imidacloprid-treated zone to feed a biscuit without insecticides. Feeding activity was 10 — 25% reduced at concentrations of imidacloprid of 1,000 — 10,000 ppm and was 53% reduced at concentration of imidacloprid of 20,000 ppm. The chemicals showed high toxicity in the oral test with *M. domestica* and in the topical application test with *B. germanica*.