

INVESTIGATION OF NEONICOTINOID INSECTICIDES AGAINST HOUSE FLY *MUSCA DOMESTICA* (DIPTERA: MUSCIDAE) AND GERMAN COCKROACH *BLATTELLA GERMANICA* (BLATTODEA: BLATTELLIDAE)

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Abstract Neonicotinoids imidacloprid and thiamethoxam share a common mode of action. They are agonist of the nicotinic acetylcholine receptor, affecting the synapses in the central nervous system. These insecticides are gaining widespread use for controlling urban insect pests in Russia. They are insecticides with stomach, contact and systemic action, with relatively low toxicity to mammals. It is known, that different OP-, carbamate -, or pyrethroid-resistant insects are susceptible to neonicotinoids. This fact is very important, because there are resistant German cockroach and housefly populations in Moscow. The aim of this study was to investigate relative toxicity and repellent action of neonicotinoid insecticides.

Two technical grades of imidacloprid 95% a.i. and thiamethoxam 95% a.i. were evaluated in laboratory conditions against standard-susceptible laboratory strains of synanthropic insects German cockroach *B. germanica*, and house fly *M. domestica*, using three techniques (topical-direct treatment of individuals; obligatory and facultative contact with treated glass-test; oral-treatment of the insect's food).

The chemicals showed high toxicity in oral test with *M. domestica* and in topical application tests with *B. germanica*. Thiamethoxam was more active than imidacloprid. The insecticides were weaker in topical houseflies and oral cockroaches experiments. LD₅₀ imidacloprid was 2.20 ± 0.76 µg/g for cockroaches and >714.3 µg/g for house flies; LD₅₀ thiamethoxam - 0.46 ± 0.09 and 10.84 ± 2.16 µg/g, respectively (registered after 24 hours). One hour obligatory contact of *B. germanica* with 10,000 ppm imidacloprid gave the male cockroaches 10% mortality level. The same mortality we observed using 100 ppm thiamethoxam treatment glass-test. LC₅₀ thiamethoxam was 500 ppm. Flushing activity wasn't observed. The percentage of dead cockroaches using facultative contact with imidacloprid treatment glass-test was the same as control (not more than 10%).

Baits (dog's biscuit), containing 5000 ppm and 10,000 ppm imidacloprid, were toxic for cockroaches (52.5% and 75% mortality after 7 days exposure and 77.5% and 88.5% after 15 days exposure, respectively). 20,000 ppm imidacloprid bait was very repellent for *B. germanica* so there was no expressed insecticide effect in experiments (22.5% after 15 days exposure). Both sugar imidacloprid and thiamethoxam baits were toxic for house flies (LC₅₀ 150 ± 37 ppm and 36 ± 4 ppm, respectively).

Repellent effect was very strong for cockroaches in special experiments when they had to cross imidacloprid zone to feed on biscuit without insecticides. Feeding activity was 10-25% reduced under 1,000-10,000 ppm concentrations and 53%, under 20,000 ppm concentration of imidacloprid.

Results showed that imidacloprid and thiamethoxam must be used only as baits formulations against cockroaches and flies in medical disinfection. Increasing of imidacloprid baits attractiveness for cockroaches is an important problem for investigators.