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MULTIRESISTANT GERMAN COCKROACHES IN RUSSIA

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Abstract From 2014 to 2016, in Moscow, Kaluga region, and Ural (Ekaterinburg) we have been monitored the susceptibility of male German cockroaches to topically applying 1µl insecticides of different structure. It was found that all cockroach populations are most resistant to pyrethroid insecticides, especially cypermethrin. Tolerance (3-13×) to pyrethroids in households and in the Moscow Zoo were registered, high resistance (140-300×) – in hospital, student dormitories or restaurant, and super-resistance we found in food market in Obninsk (>4000×). A number of the cockroach populations exhibited resistance to fipronil (10-54×). Tolerance or resistance to organophosphates (3-15×) are found in six Moscow, one Obninsk, and four Ekaterinburg cockroach populations. At the same time, these populations exhibit weak tolerance to carbamates (1-4×) and susceptibility or weak tolerance to neonicotinoids (0.7-3.5×) and avermectins (1-3×). A statistically significant delay in the expression of poisoning symptoms is found in all the studied populations upon contact male cockroach with the glass surface treated with 20 µg a.i./cm^2 of cypermethrin, chlorpyrifos, propoxur, and fipronil. A delayed insecticidal effect on resistant cockroaches or complete insecticide ineffectiveness has been established. In this regard, it is necessary to determine the level of insect resistance and develop the individual insecticide rotation scheme for each location. Analysis of the data obtained makes it possible to assume that we are dealing with the multiresistance accompanied with different genetic mechanisms - the occurrence of *Kdr*- and *Rdl*-mutations, changes in the permeability of cuticle and in the activity of enzyme systems, etc. Moreover, delay in cockroach poisoning after feeding baits based on isoxazolines, substances of new chemical class, having never been used in Russia, apparently demonstrates an increase in the level of detoxifying enzymes, in particular monooxygenases. In our situation, we can recommend to introduce into IPM system a number of baits based on aminohydrazones (hydramethylnon), avermectins (aversectin C and abamectin), and IGR (hydroprene which controls cockroach reproduction). It is necessary to use boric acid-based baits and agents with mechanical type of action - sticky traps, diatomaceous earth, which causes desiccation of cockroaches and their sufficiently rapid death.