PRECISION TARGETING: A POTENTIAL TOOL FOR ECONOMIZING NON-CHEMICAL THERMAL CONTROL OF GERMAN COCKROACHES

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German cockroach populations in military food service facilities have been the target of intensive chemical control for decades. Despite the development of new insecticides and application techniques, some facilities remain chronically infested. These chronic infestations are due, in large part, to the development of physiological and behavioral resistance to insecticides, as well as the failure or inability to deliver insecticides to the harborage areas.

Heat has proven to be an effective means of producing unprecedented long-term control of German cockroaches in U.S. Army food service facilities (Zeichner, et. al., 1996). For example, in one military dining facility the pre-thermal control trap index was 44 and dropped below a trap index of 2 following thermal control and remained below this level for all but 1 of the 18 months. Following the thermal control treatment, only one application of residual insecticide was made to keep the population abated, as opposed to 14 applications during the 18 months prior to thermal treatment. This process involved: caulking holes in walls, turning off all electrical equipment, sealing exhaust vents, applying an insect growth regulator (IGR), and heating the facility with 400,000 Btu direct-fired propane heaters for 4 to 6 hours until a target temperature of 46^0C (115^0F) for 45 minutes was reached or no cockroach movement was observed. Temperatures frequently reached 65^0C (150^0F) at the ceiling while some areas at floor level remained below 46^0C (115^0F). Cockroaches that congregated in relatively cool spots were vacuumed periodically during the process. Following heating, a residual insecticide and IGR were applied to control those cockroaches surviving the heat treatment and vacuuming.

While thermal control is effective it is also labor intensive and disruptive to the facility. Larger facilities have required up to two days to prepare and treat. Cockroaches are communal animals that are not uniformly distributed throughout the facility. In many cases, it is relatively small areas of the facility or a few pieces of equipment that serve as the foci for repopulation of the facility. Therefore, in many heat-treated facilities, considerable effort and time is expended heating areas which are not harboring cockroaches. Spatial analysis, used in the context of precision targeting, offers a strategy to reduce the area being heat treated. By studying the population contour maps produced by spatial analysis the most infested equipment or areas can be targeted for heat treatment. By limiting the area to be heated the heat treatment can be greatly simplified. For example, in one kitchen a 12 foot pot and pan wash area with two sinks, garbage disposal and hot

water booster was heated. The equipment was easily and quickly covered with 4mm plastic sheeting, there was no need to shut down the entire facility, turn of all the equipment, seal exhaust vents or exclude workers from the facility. Target temperatures were reached within 1 hour with a smaller, more portable, 150,000 Btu heater.

Technological advances, particularly in the area of electronics, have resulted in significant improvements in the safe production, management and monitoring of heat. Direct fired technology results in near complete combustion of propane with minimal toxic emissions, for example, carbon monoxide levels of the heated air are less than 5 ppm for each 100,000 Btu's produced. Heat shares several characteristics with methyl bromide such as the ability to penetrate harborages, kill all life stages, and leave no residual. Heat has distinct advantages over methyl bromide such as being safer to use, environmentally acceptable, and being able to enter the treated area during and immediately after treatment. The biggest limitation of heat is the effort required to treat large areas or masses. Spatial analysis offers the potential to identify pest foci and greatly reduce the area or mass requiring heat treatment, thus increasing the applicability and viability of using this methodology as part of an integrated approach to pest control.

Reference:

Zeichner, B. C., D. F. Wood & A. L. Hoch (1996). The use of heat for control of chronic German cockroach infestations in food service facilities - A fresh start., In The Proceeding of the 2nd International Conference on Insect Pests in the Urban Environment, Edited by K. B. Wildey.

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