

A READY-TO-USE DELTAMETHRIN FORMULATION FOR CONSUMER USE, WITH IMPROVED RESIDUAL ACTIVITY ON PUBLIC HEALTH PESTS

SARA ST. JOHN¹, ISABEL HERNANDEZ¹, JOHN LUCAS¹, AND DAVE JOHNSON²

¹ AgrEvo Environmental Health, 95 Chestnut Ridge Road, Montvale, New Jersey, 07645 USA

² AgrEvo USA Company, 1740 Whitehall Road, North Muskegon, Michigan, 49445 USA

Abstract - Control of insects by the consumer, within the home and around the perimeter to prevent pest invasion requires products that have certain key features. These include fast action, extended activity, low/no odor, no marking/staining of surfaces, and convenience of application. Current products that are used to control cockroaches, ants, fleas and other pests include aerosols and water-based emulsions. A new water-based formulation of deltamethrin (DeltaGard®) has been developed that captures the features described above in a ready-to-use form. One of the useful properties of deltamethrin among the pyrethroids is its crystalline nature, even at elevated temperatures, making it possible to produce water-based suspensions. Once applied, these formulations are highly effective and long-lasting, even on absorbent surfaces.

The new formulation will provide the homeowner with an extremely user-friendly approach to insect control, both in and outdoors. Visibility of the deposit and odor are negligible and there is no requirement to shake the formulation prior to use. Biological performance is exceptional for a homeowner product. Fast action and extended efficacy on a variety of surfaces is demonstrated against a wide range of public health and nuisance pests.

Key words - Suspensions, porous surfaces, pyrethroids

INTRODUCTION

A new, water-based suspension of deltamethrin (DeltaGard®, Registered trademark of AgrEvo Environmental Health, Inc.) has been developed and will soon be introduced as a ready-to-use (RTU) product to the USA consumer market. Water-based emulsions currently dominate the liquid RTU market in the USA. These emulsions provide short residual activity and require shaking before use. Suspensions, in contrast, have excellent residual activity on porous surfaces, are water based and have low/no odor. However, suspensions usually require shaking before use.

The new formulation described here combines all the performance benefits of a suspension in a product that does not require shaking. This results in an ideal consumer product that combines convenience in use with excellent biological performance.

Three concentration levels of this deltamethrin formulation were evaluated in the laboratory against German cockroaches, *Blattella germanica* (L.), carpenter ants *Camponotus* spp., house crickets, *Acheta domestica* (L.) and cat fleas, *Ctenocephalides felis* (Bouche). Ceramic tile was selected as a non-absorbent, chemically non-reactive surface, while concrete was chosen to represent the opposite extreme: highly absorbent and chemically reactive (alkaline); carpet was used as the substrate for fleas.

MATERIALS AND METHODS

Insects tested

All insects were adults: male German cockroaches, carpenter ant workers, mixed-sex house crickets and cat fleas.

Products

Experimental formulations: deltamethrin (DTM) 0.01% RTU; deltamethrin 0.02% RTU; deltamethrin 0.03% RTU. Commercial products: permethrin (PRM) 0.25% RTU; chlorpyrifos 0.50%, bioallethrin

0.05%, N-octyl bicycloheptene 0.16%, piperonyl butoxide 0.10% EC RTU (CPE/BA EC); chlorpyrifos 0.25% Micro-encapsulated (CPE ME); bifenthrin (BFN) 0.05% RTU; diazinon (DZN) 0.075% RTU; chlorpyrifos 0.5% EC RTU (CPE EC).

Surfaces

Ceramic tile, concrete blocks and carpet were treated and tested for residual activity.

Procedure

Surfaces were treated from a distance of 45-cm by applying 1g of formulation on a 9-cm diameter circle. The commercial products were sprayed from their original containers and trigger sprayers. Deltamethrin formulations were applied using Continental T-74N15 trigger sprayers (Continental Sprayers, 27 Guenther, St. Peters, MO, 63376, USA). Three replicates were made for each insect, product and surface. The surfaces were exposed to normal laboratory conditions (22 °C, 60% relative humidity, and continuous fluorescent light). Residual tests were conducted at various intervals up to six months after treatment, depending on species tested. After recording knockdown, insects were given food and water as appropriate and placed in a laboratory growth chamber (24 °C, 60% RH, and 12:12 photoperiod).

Testing procedure for German cockroaches, carpenter ants and house crickets

Prior to testing, the insects (10 cockroaches, five ants and five crickets per replicate) were confined on clean surfaces using appropriate containers. The insects were walked onto the treated surfaces, confined there for 1 minute, and walked back onto the clean surfaces. All insects were placed in clean jars and observed for knockdown every 2 minutes for the first 12 minutes, then at 15, 30 and 60 minutes. An insect was considered knocked-down if it was on its back and could not right itself.

Testing procedure for cat fleas

Two-inch treated nylon carpet circles were placed at the bottom of a 500-ml glass cylinder. Ten cat fleas were added and knockdown was observed. Knockdown was recorded every 2 minutes for the first 12 minutes, then at 15, 30 and 60 minutes. Knockdown was recorded if fleas did not jump in response to exhaling (CO₂) into the cylinder.

RESULTS

The results are shown in Figures 1-8. Calculation of knockdown times was determined by probit analysis. Mortalities were recorded at 24 hours. The laboratory trials showed that the deltamethrin RTU provided excellent knockdown and residual efficacy against all insects.

Knockdown

From Figure 1, it can be seen that the pyrethroid sprays provided significant knockdown of German cockroaches within 30 minutes, deltamethrin and permethrin providing the best performance. The organophosphate-containing products had no knockdown at 1 hour. German cockroaches: On ceramic tile (Figure 2) excellent performance was provided by the deltamethrin and permethrin formulations, whereas on concrete (Figure 3) only deltamethrin at 0.02% and above gave good control through 1 month. Carpenter ants: On ceramic tile was good for all products except the CPE/BA formulation through 2 months (Figure 4). On concrete (Figure 5) all formulations performed well at 2 weeks but only deltamethrin provided control at 2 months. House crickets: On ceramic tile, (Figure 6), deltamethrin and permethrin formulations gave high levels of control through 2 months, and only the higher levels of deltamethrin continued for another month. On concrete (Figure 7), 0.03% deltamethrin gave control superior to the other products. Cat fleas: On treated carpet (Figure 8) control was generally good through 3 months for deltamethrin, permethrin and chlorpyrifos EC. Inconsistent and poorer control was demonstrated for the other products.

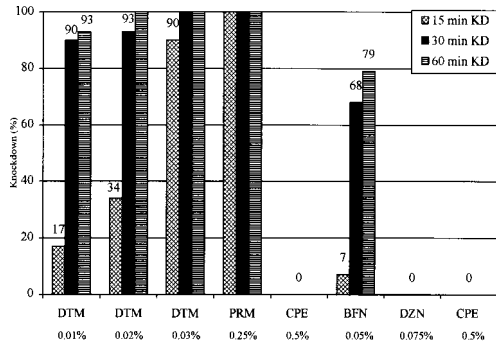


Figure 1. Knockdown (KD) Performance of Deltamethrin RTU vs. Commercial Products against German Cockroaches.

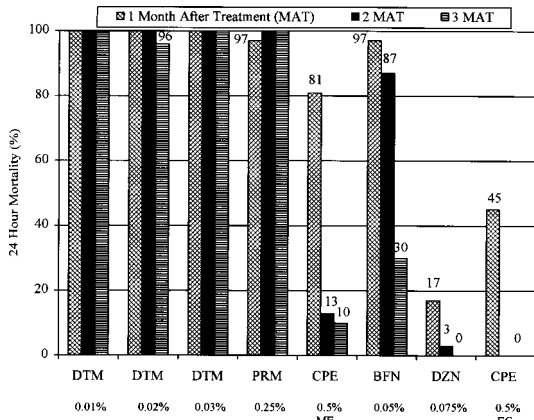


Figure 2. Residual Performance of Deltamethrin RTU vs. Commercial Products on Ceramic Tile against German Cockroaches.

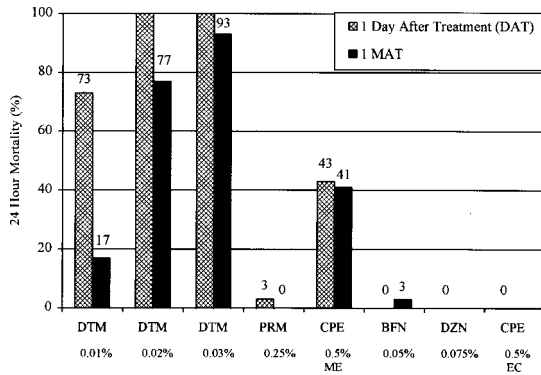


Figure 3. Residual Performance of Deltamethrin RTU vs. Commercial Products on Concrete against German Cockroaches.

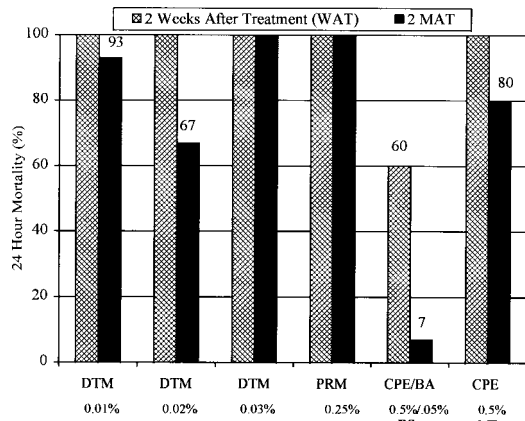


Figure 4. Residual Performance of Deltamethrin RTU vs. Commercial Products on Ceramic Tile against Carpenter Ants.

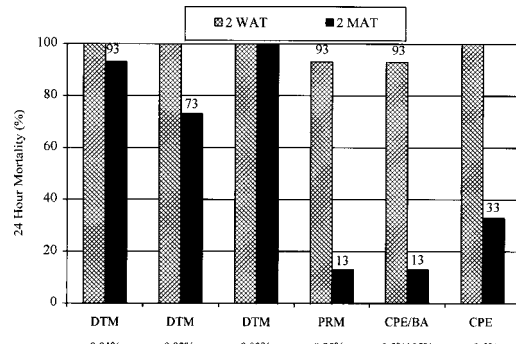


Figure 5. Residual Performance of Deltamethrin RTU vs. Commercial Products on Concrete against Carpenter Ants.

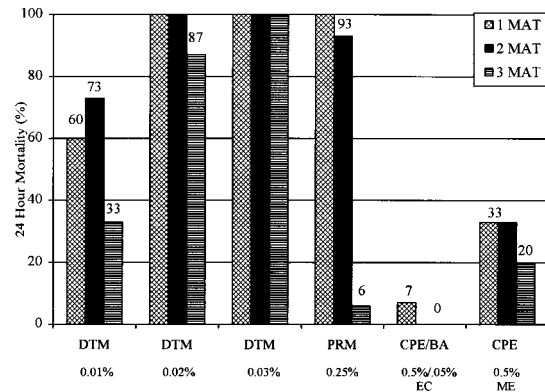


Figure 6. Residual Performance of Deltamethrin RTU vs. Commercial Products on Ceramic Tile against House Crickets.

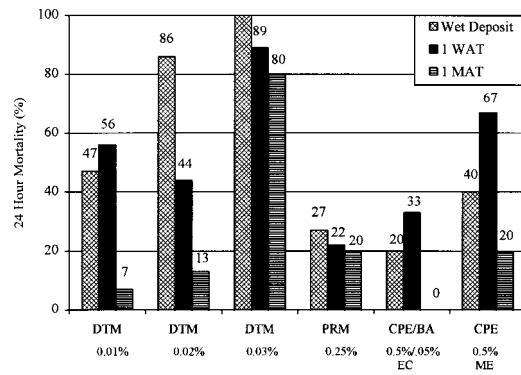


Figure 7. Residual Performance of Deltamethrin RTU vs. Commercial Products on Concrete against House Crickets.

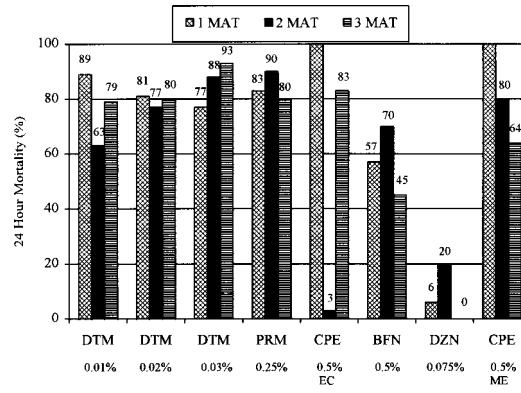


Figure 8. Residual Performance of Deltamethrin RTU vs. Commercial Products on Carpet against Cat Fleas.

DISCUSSION AND CONCLUSION

The improved performance on porous surfaces of particulate-containing formulations, such as suspensions and wettable powders, has been noted in previous papers. Beesely and Chadwick (1986), for instance, reported a 7-fold decrease in the amount of insecticide required to produce an effective residual deposit when changing from an emulsion to a particulate formulation. This is a direct result of the increased availability and hence pick-up by the insect of the insecticide when presented in particulate form.

Deltamethrin RTU consists of solid particles of the pyrethroid in a water-based formulation. Its improved residual performance over emulsions, on a variety of surfaces, is consistent with previous observations. This new formulation has been shown to provide several key features considered important for consumer use. These include a) fast action with high level knockdown within 15-30 minutes, b) residual activity on porous and non-porous surfaces extending through at least 3 months and c) broad spectrum activity on key urban and public health pests. In addition, deltamethrin RTU combines excellent biological performance with consumer convenience. The formulation is easy to use as shaking is not required, and it has virtually no odor. Once sprayed, the wet residue has low mobility, when dry it has low visibility and is non-staining. Registration in the USA is expected in 1999.

REFERENCES CITED

- Beesley, J. E. and Chadwick, P. R. 1986.** The activity of insecticides on surfaces. Proceedings of the British Pest Control Association Annual Conference, Brighton, UK, 29th May – 1st June 1986: Session 3, paper 2.
- Chadwick, P. R. 1985.** Surfaces and other factors modifying the effectiveness of pyrethroids against insects in public health. *Pesticide Science*. 16: 383-391