N O T E

Coated Containers with Reduced Concentrations of Fluon to Prevent Ant Escape[1]

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Successful maintenance of colonies is crucial for many laboratory studies on ants. Containers of different compositions such as plastic, glass, or metal can be used to house ant colonies in the laboratory. However, adult ants can climb up the walls of almost all types of containers and escape without some preventative measures. The most commonly used method to prevent ant escape is to coat the inner walls of a container with either "slippery" or sticky substances. Fluon, petroleum jelly, heavy mineral oil, and talcum powder have been used for this purpose. Fluon is the preferable choice in low humidity conditions (Hölldobler and Wilson, 1990, The Ants. Belknap Press of Harvard University Press, Cambridge, MA).

Fluon encompasses a range of products with a range of usages. However, in the ant research community, it usually refers to Fluon aqueous dispersion (AD) resin. Fluon products are graded based on the amount and particle size of polytetrafluoroethylene (PTFE) and amount and type of wetting agents. For example, Fluon® AD1 (AGC Chemicals America, Inc., Moorestown, NJ), which has been extensively used in our laboratory, contains 59-62% PTFE and 6.0-7.0% nonionic wetting agent. Fluon® AD1 has 9-11 pH and the particle size of PTFE is 0.27 μm (http://www.wireworld.com/agflu/fluonaquaprop.html). This product provides the benefits of PTFE to different surfaces through impregnating or coating. Some characteristics of Fluon coating include thermal stability (up to 260°C), chemical inertness, and low coefficient of friction.

Although there is no direct evidence on toxicity of PTFE to humans, the toxicity of PTFE fume from overheated cookware as to birds has been reported (http://www.ecavianassociation.com/healthsaftey/tef.asp) and release of Fluon into the environment should be minimized. Effort should be made to minimize its use to reduce the cost of the coating because Fluon is also expensive ($26.42/L). Thus, the objec-

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tive of this study was to evaluate the effectiveness of coating with low concentrations of Fluon to prevent escapes of fire ants in laboratory containers for the purpose of minimizing the amount of Fluon used in container coating.

Four types of containers commonly used in the laboratory were included. They were plastic trays (52 × 39 × 7.5 cm, U. S. Plastic Corp. Lima, OH), disposable Petri dishes (9.0 × 2.5 cm, LABORATORY-TEK Brand, Nalge Nunc International, Rochester, NY), glass beaker (1000 ml Pyrex beaker, Corning Inc., Corning, NY), and aluminum pans (33.0 × 7.6 cm, the bottom pan of the official grain dockage sieves, Seedburo Equipment Co., Chicago, IL).

Fluon (Grade AD1, 59-62% polytetrafluoroethylene in water) was purchased from AGC Chemicals America, Inc., Moorestown, NJ. A series of dilutions were made by adding distilled water to the original AD-1 product, and resulted in solutions of 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256, and 1/512 of the original product (v/v). The inner walls of the containers were coated with a solution using a foam brush (9 cm wide) in such a way that no excessive liquid or bubble accumulated on the surface after the coating. Each solution was replicated three times for each type of container. Coated containers were allowed to air dry at room temperature for about 2 h before use. Three hundred red imported fire ant, *Solenopsis invicta* Buren, workers were then released into each coated container. Crickets and 10% sugar solution were provided for food. The test containers were maintained under normal laboratory condition (25-28°C, RH 45%) and were checked daily for 14 d to determine if any ants climbed up the coated walls of the containers and/or escaped.

Fire ants were not able to climb up the wall of the plastic trays coated with Fluon at a concentration as low as 1/128 of the original solution of AD-1 product during the observation period (Table 1). This was equivalent to a 0.4% PTFE in aqueous solution (note that the original solution contained 52-69% PTFE). For the aluminum pans, a lower concentration of 1/256 of the original solution effectively stopped the ants from climbing up the coated wall. PTFE in this solution was only 0.25%. However, for both glass beakers and disposable Petri dishes, concentrations $\geq$ 1/16 of the original solution were needed. Because a one-fold dilution decrement was used, the above concentrations may not represent the lowest effective concentration of Fluon on each type of the tested containers.

Table 1. Effectiveness of Fluon® coating at reduced concentrations on various container types

Container type	Dilutions of original Fluon solution*									
	1	1/2	1/4	1/8	1/16	1/32	1/64	1/128	1/256	1/512
Aluminum pan	+	+	+	+	+	+	+	+	+	–
Disp. Petri dishes	+	+	+	+	+	–	–	–	–	–
Glass Petri dishes	+	+	+	+	+	–	–	–	–	–
Plastic tray	+	+	+	+	+	+	+	+	–	–

* "1" = the original product without dilution; "1/2" = half of the original solution. "+": effectively stop ant climbing up the coated surface in all three replicates for a period of two weeks. "–": did not completely stop ant climbing up the coated surface in all three replicates.

In our laboratory, the 1/32 dilution has been the selected Fluon concentration for coating plastic trays. Plastic trays coated with this concentration have been used for more than 5 months. However, we recoated 2 of the 20 trays because of the large size of the ant colonies. It is not unusual to recoat a tray coated even with undiluted original Fluon solution, for particularly large ant colonies. This is because a large number of ant workers tend to pile up at a corner of the tray, which makes it easier for them to escape. In general, the 1/32 dilution worked well for this purpose. However, if the colony would last for more than a year or the colony is too large, a more concentrated solution may be necessary.

Besides the benefits of cost saving and less contamination to the environment, use of diluted Fluon has the following extra benefits: (1) little or no bubble was produced in the coating process which results in a smoother surface; (2) less Fluon was used, which makes it easier to clean the coated container; and (3) the dry film of diluted Fluon was nearly invisible which improved the aesthetics.

Based upon these results, we recommend the use of diluted Fluon solution to coat containers. Our conservative recommendations are as follows: 1/25 dilution for coating plastic trays; 1/50 dilution for coating aluminum containers; and 1/16 for disposable or glass Petri dishes.

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