Caffeine Termiticide: Caffeine as a Novel and Eco-friendly Termiticide

Koay, Xian Jing
Chng, Zhan Yi

Caffeine (1,3,7-Trimethylpurine-2,6-dione), an inexpensive and easily extracted compound from the coffee and tea plants, is a natural pesticide. It is also known that termites cause around 30 billion USD of property damage globally per annum. For decades, the usage of termiticides like fipronil has caused its bioaccumulation in the food web, gravely endangering the ecosystem. This research proposes using caffeine as an eco-friendly termiticide. The caffeine used was extracted from tea via dichloromethane liquid-liquid extraction. The effect of caffeine on the mortality of a common termite species in Southeast Asia (Coptotermes gestroi) is studied, and is compared to fipronil and distilled water. The experiments consist of 33 no-choice bioassays, each containing a wood block immersed in distilled water, and caffeine or fipronil solutions at concentrations of 0.4%w/v, 0.8%w/v, 1.2%w/v, 1.6%w/v and 2.0%w/v respectively. It is found that the percentage mortality for caffeine is (31.583±23.005)%, higher than percentage mortality for distilled water (14.583±8.908)%, and lower than percentage mortality for fipronil (90.000±19.112)%, with a significant difference between caffeine and fipronil ($F(1,20) = 130.381$, $p = 0.000$, 2-way ANOVA). Percentage mortality increases with caffeine concentration, reaching a peak at 1.2% concentration, with a corresponding percentage mortality of (86.667±9.661)%. Qualitative observations made throughout the experiments and repellency of each treatment are investigated. Repellency of caffeine is also discovered to increase with caffeine concentration. It is proven that caffeine is an effective and eco-friendly termiticide that benefits both humanity and the environment, solving problems of proliferating termites and pollution simultaneously.

Awards Won:
Third Award of $1,000
American Chemical Society: Certificate of Honorable Mention